THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXV. No. 1653.] LONDON, JANUARY 15, 1895. [47TH YEAR. PRICE 6d.

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NOTE. — Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts and covers, and rendering leakage impossible.

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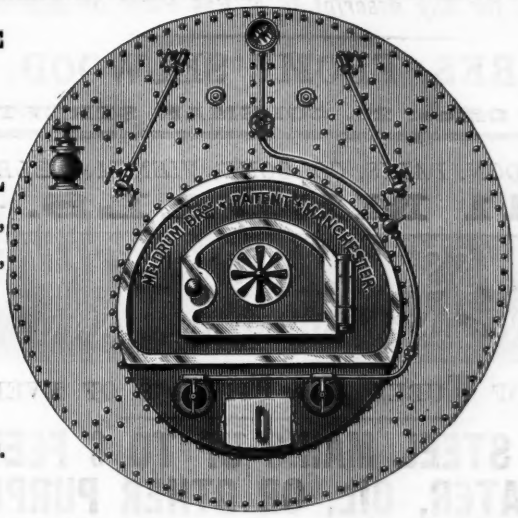

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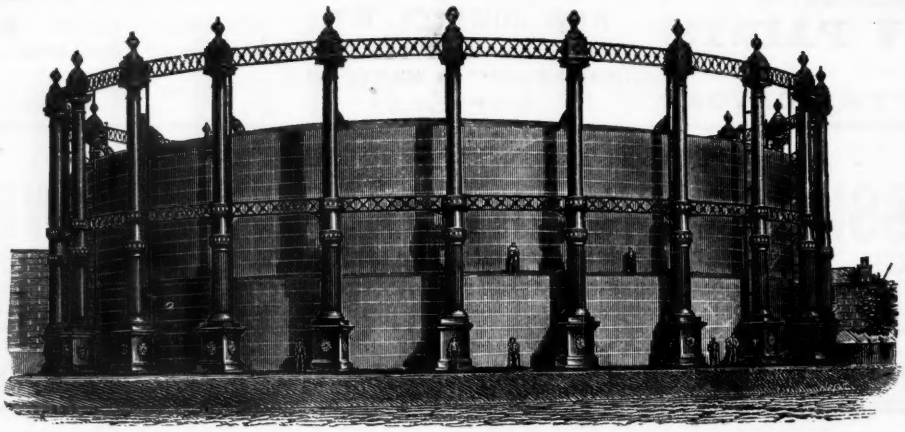

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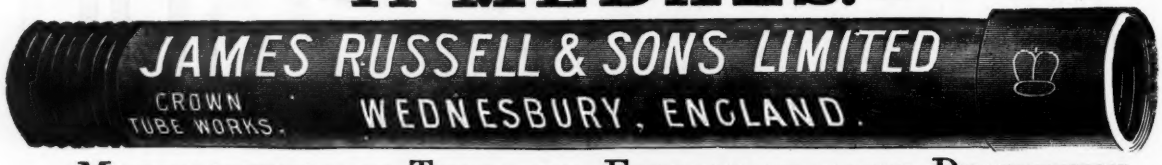

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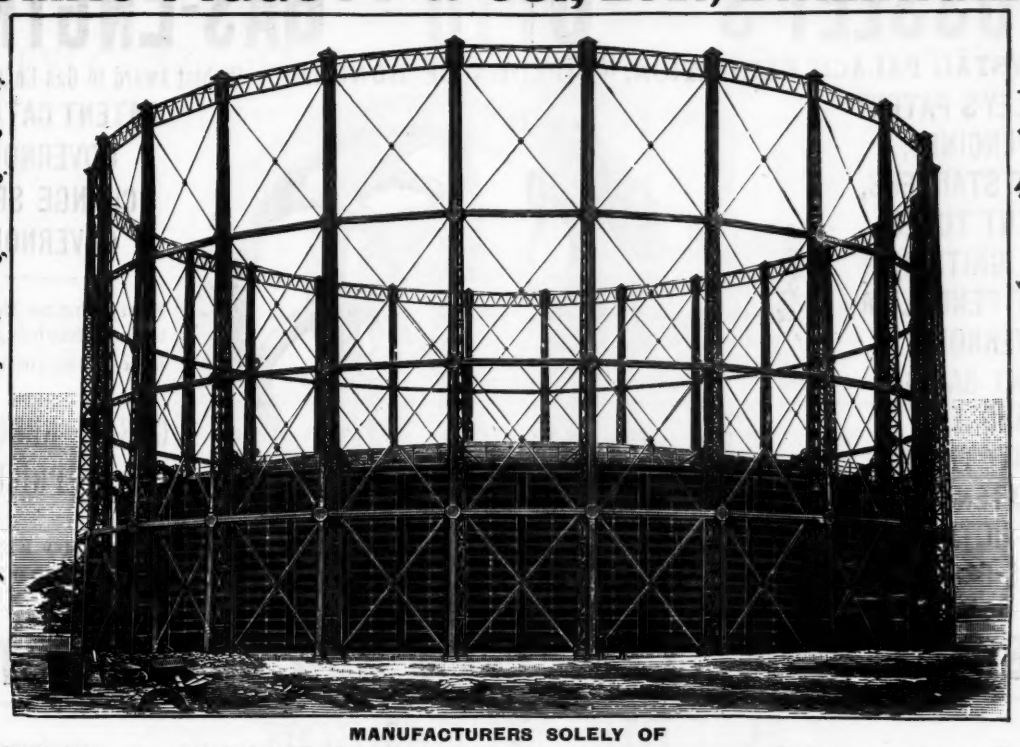

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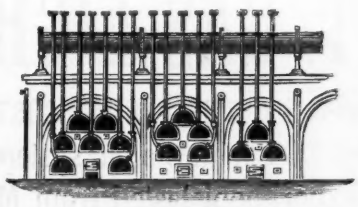

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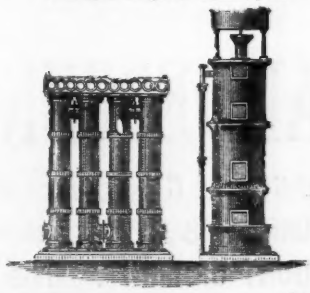

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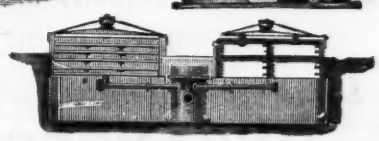

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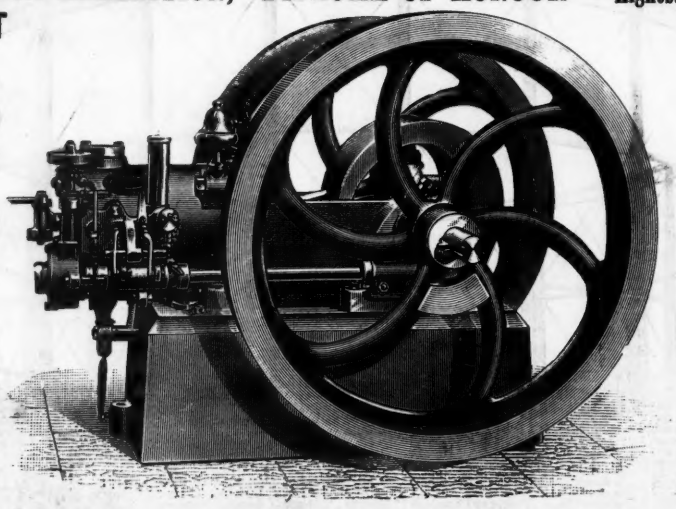

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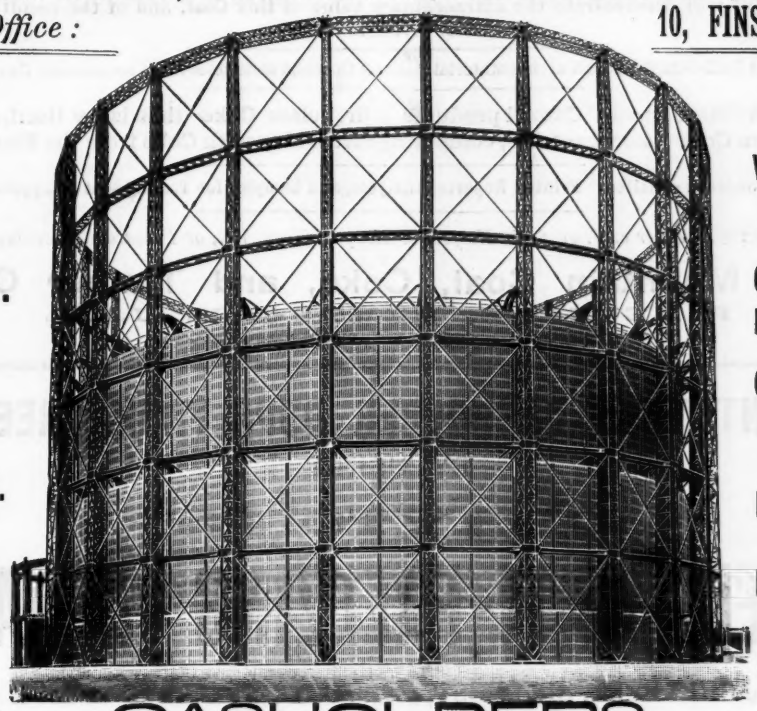

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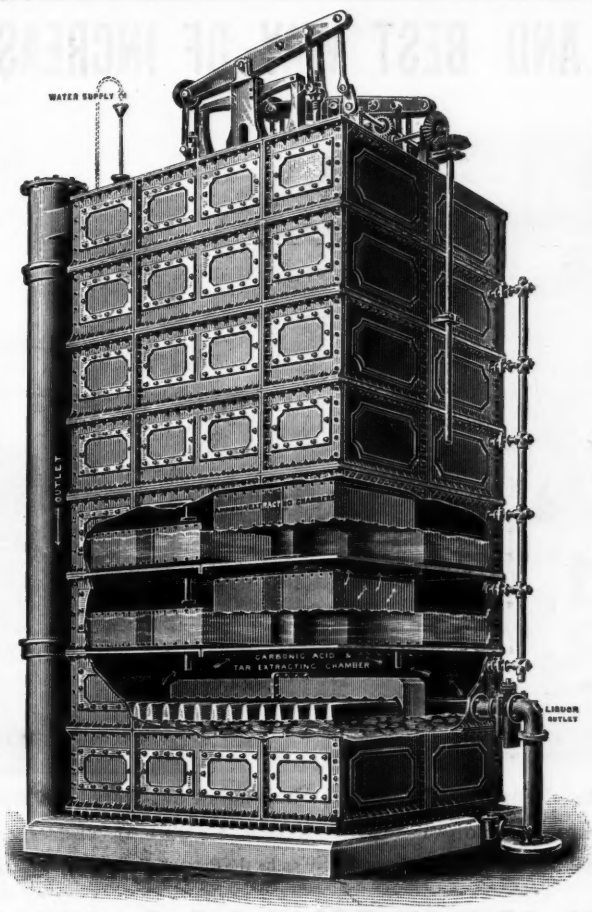
REMOVES ALL TAR & AMMONIA.

And from 40 to 50 per cent. of the Carbonic Acid and Sulphuretted Hydrogen.



REMOVES ALL TAR & AMMONIA.

And from 40 to 50 per cent. of the Carbonic Acid and Sulphuretted Hydrogen.

REMOVES ALL TAR & AMMONIA.

REMOVES ALL TAR & AMMONIA.

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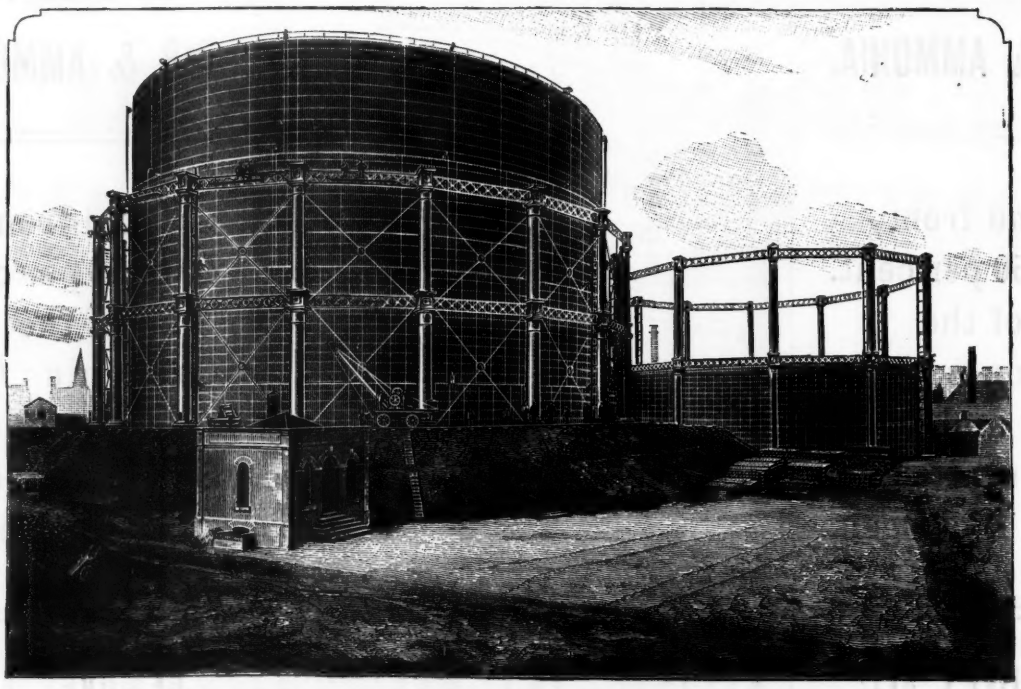

From a Photo. of Four-Lift Holder at the Birkenhead Gas-Works, 160 ft. by 30 ft.

TWO LIFTS added to existing Holder on the ROPE SYSTEM, thereby doubling the Capacity.

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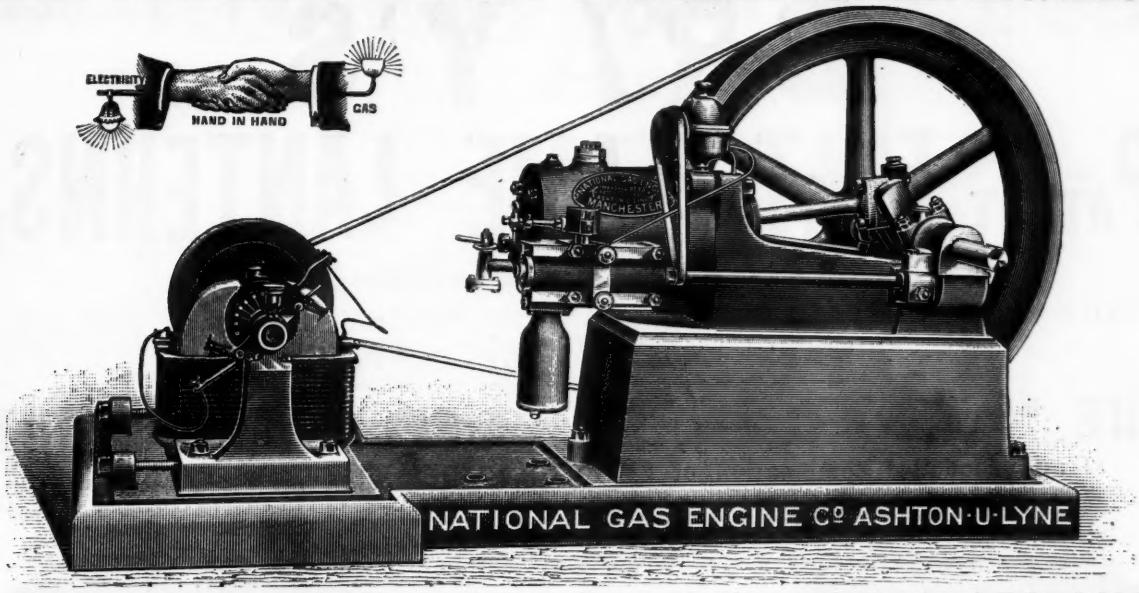

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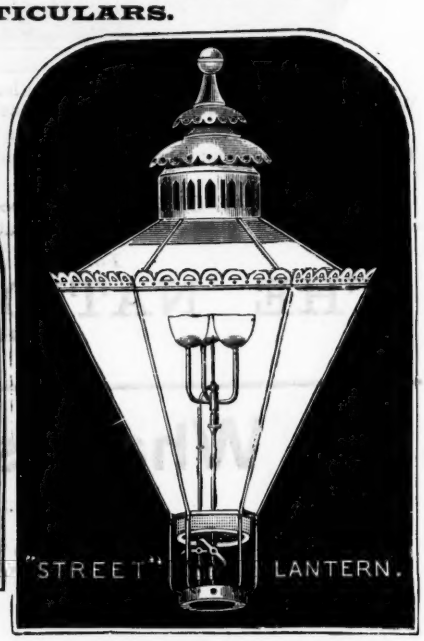

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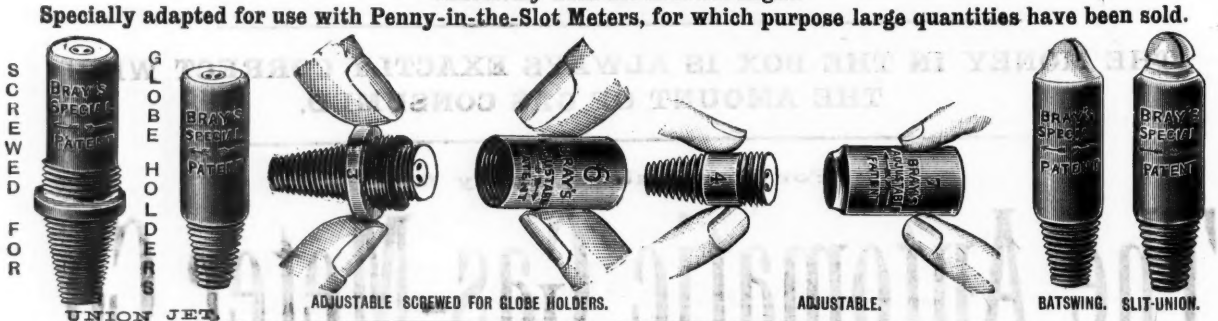
Specially adapted for use with Penny-in-the-Slot Meters, for which purpose large quantities have been sold.



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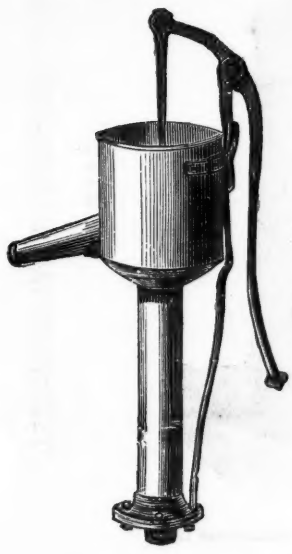

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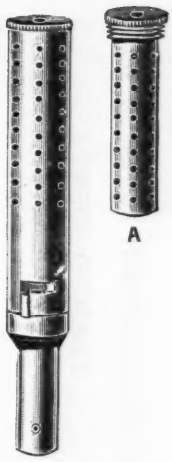

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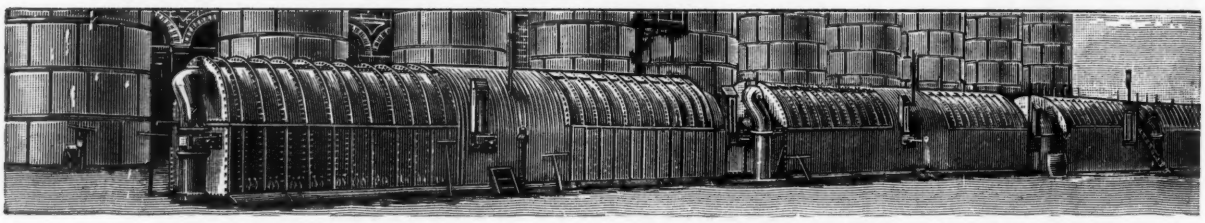
☛ **484** of these Machines (capable of dealing with **464,490,000** cubic feet of Gas daily) in use which fact is given as evidence of this apparatus being the Most Efficient of any in the Market for the extraction of Ammonia, Carbonic Acid, and Sulphuretted Hydrogen from Coal Gas.



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SQUARE STATION METERS WITH PLANED JOINTS.

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RETORTS CAREFULLY PACKED F.R EXPORT.
Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.

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ALDWARKE MAIN GAS COAL

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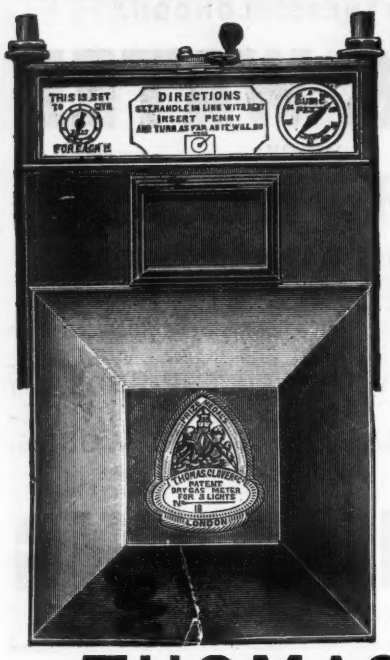

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[See also Advt., p. 148.

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EDITORIAL NOTES.

Plunder or Progress?

THE periodical called *London* has ventured upon a reply to the comment upon its views of Metropolitan gas polity which appeared in these columns three weeks ago. We then exposed the fallacy of what was put forward as the "Progressist" view of the possibility of saving for the ratepayers of London the money represented by that proportion of the gas bill of the Metropolis which goes to pay dividends. The statement had been put in circulation—possibly for electioneering purposes—that upwards of a million sterling could be "saved" by a Municipality having control of the London Gas Supply, and applied in reducing the price of gas and raising the standard of its illuminating power. We showed, in a very few words, that this "saving" could not be secured by any means not inconsistent with respect for the statutory rights of the proprietors of the existing Gas Companies. The demonstration was effectual; for now, although *London* pretends to return to the charge, it is careful to disclaim having contemplated the "saving" as the reason why the London County Council should attempt to expropriate the Companies. "We said nothing about the County "Council municipalizing the gas. We simply meant "that if we had had a municipality in London supplying "gas instead of companies—as they have in provincial "towns—the profit would go to the community instead "of a few shareholders." This is ingenious, but not convincing. For it is hardly like a "Progressist," who should at least live in the present, if not in the future, to enter into an elaborate calculation of what might have been if something that is had been otherwise. We still take the liberty of regarding the calculation in question as having been prepared as a bait for Metropolitan electors, and shall expect to hear of its use for this purpose when the County Council elections come round. It is something to have secured acceptance of the truth that "the County "Council, if it were to buy out the Companies, would have "the cost of the debt to meet;" and it may be remarked, in parentheses, that the amount of this debt would not be fixed at the will of the County Council. The admission is qualified by the observation that the cost of the debt "would not by any means swallow up the profit. There "would be economies in administration if there were one "municipal concern instead of several companies." These considerations are as may be. Economies of administration are not everything, even in gas supply. Efficiency is more; and we should not be at a loss to name examples of municipalized gas supply in which the "penny wise and "pound foolish" trick of municipal administrators costs the community untold sums.

Having given up the "saving" pretension, however, *London* professes to be more concerned with the alleged shortcomings of the Metropolitan Gas Companies, and particularly the South Metropolitan, in regard to the illuminating power of the gas supplied. The existence of Gas Referees and Gas Examiners is brought forward as a proof that the public cannot trust the Companies to do their duty; and we are treated to a repetition of the old story about the gas supplied to the legal testing-stations being different from that sold to ordinary consumers. Well, we are not aware that Parliament has ever exempted any gas supply from examination merely because it happens to be supplied by a public authority; but we do know that zealous gas examiners are greatly more in favour with municipalities when the gas supply is provided by a company, than they are when the municipalities do the work themselves. The London County Council doubtless enjoy the spectacle of the persevering Mr. Dibdin trundling his favourite portable photometer to different Board Schools in the wilds of Rotherhithe and Deptford; but we have a shrewd suspicion that, if the gas consumed in those parts were of their own production, the inquisitive instrument in question would be put away in a back yard somewhere, and forgotten. We may be much mistaken, of course, not being "Progressist," and consequently subject to human infirmity; but it is strong support for our views in this regard that there is no demand for portable photometers in towns supplied with gas by the local authorities.

Is the Coke Market Forestalled?

THERE was held not long ago, at the Cannon Street Hotel, a privately convened meeting of manufacturers of Portland cement. The chair was taken by Mr. Bevan, of the firm of Messrs. Knight, Bevan, and Sturge; and the proclaimed object of the gathering was the formation of an Association of members of the trade. There is nothing novel or strange about the proposal to organize the members of any trade or industry into an Association; but there was something decidedly peculiar about the movement set on foot by Mr. Bevan, and formally inaugurated at the Cannon Street Hotel meeting, inasmuch as it had for its ulterior and apparently only purpose the publication, on behalf of the Associated cement firms, of a statutory declaration to the effect that they had never manufactured Portland cement except in a particular way. The declaration was aimed at certain firms who make no secret of their determination to conduct the manufacture in any way that best enables them to command good trade at home and abroad. One of the speakers at the meeting, who did not appear to see just eye to eye with the Chairman, was Mr. Leedham White, of the firm of Messrs. John Bazley White and Brothers, Limited; and in the course of a temperate and well-reasoned address to his fellows in the trade, Mr. White took the opportunity of pointing out that an Association of Portland Cement Manufacturers might do more for the trade than anything sketched out in the Chairman's very meagre programme. "It might be "a useful Association to determine, for instance, what "should be the action of the trade when it came to the "question of buying fuel." (This remark was received with laughter.) Just before this, Mr. White had said of the cement firms: "Although we could cut each other's throats, "we have no enmity to each other; and although we "think of ourselves first, it is no pleasure to a man with "a heart to think that other people are going home "sorrow-stricken, not knowing where they are to get money "for their next week's food."

Though it is not apparent at the first glance, there is nevertheless a real connection, if rumour speaks truly, between these somewhat lugubrious reflections of Mr. White and the remark that drew laughter from his auditory. There was no enjoyment in that laugh, which was rather the acknowledgment which a crowd gives of a palpable hit by a speaker, than a sign of real mirth. Gas makers are interested in the fortunes of the Portland cement industry, by reason of the fact that the cement manufacturers are the largest buyers of their surplus coke. The heaviest coke contracts are made by cement firms; and it is these contracts which virtually determine the market value of coke from year to year—at any rate, in the South of England. Rumour has it that during the past few months coke has been accumulating in the big gas-works, owing to the action of certain large operators in the cement trade in establishing what was intended to be a "corner" in coke, with the unconcealed object of starving out the small manufacturers. To accomplish this design, all that was necessary was to obtain contracts for large quantities at a high figure, and so to raise the price of coke against other wholesale purchasers to a prohibitive level, and keep it there for a few months, until the weaker cement firms had gone under. The cost of doing so would, of course, be considerable; but there are millionaires to whom it would be insignificant, in view of the recompense to be looked for subsequently from a close trade, when the price would fall lower than ever, owing to the extinction of much of the previous demand for it. For not only the smaller cement firms, but likewise many other manufacturers who were in the habit of using coke for fuel, have been choked off by the "cornering" manœuvre. Unfortunately, it is asserted that some producers of coke in large quantities have not been sharp enough to see through the design of the forestaller, and have accordingly become saddled with large contracts for supply at prices that looked tempting enough on the surface. Others, more prudent, limited the amount of their obligations in the same quarter, and, now it is seen that the effect of the "corner" is disastrous, are putting down their prices right and left, to small contractors as well as for yard sales, in order to save their connection. So, at least, the story goes. If it is true, it not only furnishes the key to Mr. White's oracular utterances, but will supply a necessary light for the interpretation of certain Gas Companies' accounts which will soon be published.

The Gas Question in Dublin.

THE Lord Mayor of Dublin is diligently prosecuting his newspaper controversy with Mr. Edward Fottrell, the Chairman of the Alliance and Dublin Consumers' Gas Company, with the evident object of working up popular fervour in support of the Corporation Bill, which is not half so well liked by the ratepayers as the municipal politicians could wish. Indeed, the Corporation scheme of legislation would probably be scouted by every citizen who does not live upon the rates, were it not for the onslaught it makes upon the Gas Company, who have committed the unpardonable offence of becoming one of the few prosperous native industrial undertakings of the Irish capital. The Lord Mayor, having accused the Company of supplying gas deficient in illuminating power, has been challenged by Mr. Fottrell to prove his words; which, of course, he has no intention of doing. The Chairman of the Company has driven his adversary from this point, and has also succeeded in driving home to the popular mind, as represented by the newspapers, a sense of the truth that the Dublin so-called 16-candle gas, which is tested by a flat-flame burner, would rank as 17½-candle gas if tested by means of an Argand burner, like every other supply of the same intrinsic quality throughout the kingdom. Then the Lord Mayor falls back upon the subject of price, and asserts that Dublin gas at 3s. 7d. per 1000 cubic feet is too dear. This is naturally a more popular point to take against the Company. The example of Belfast, where the top price of gas is 2s. 8d. per 1000 cubic feet, is hurled at Mr. Fottrell's devoted head; and he is told that the Corporation mean to get Parliament to make the Company conform to something like average rates. Mr. Fottrell's mild protest that it is unfair to compare the gas business in the Dublin district, with 10,000 consumers scattered over the land at the rate of 26 per mile of main, with that of Belfast, where 24,000 consumers make an average of 87 per mile of main, goes for nothing with the Corporation and the newspapers. It might be thought that the simplest thing for the Corporation to do would be to ask Parliament to enact that the price of gas in Dublin should always be the same, candle for candle, as that of Belfast. But they shrink from going to this length—we cannot tell why. They even put 3s. 4d. in their own Bill as a fair initial price for Dublin gas; and if they were offered the gas-works to-morrow, subject to the obligation to conform to Belfast prices, they would not take them. What, then, does the difference between the Mayor and the Chairman of the Gas Company, with regard to what is a fair price for Dublin gas, really amount to? Apparently, to no more than 3d. per 1000 feet; and this even while the Corporation remain oblivious of the meaning of the figures as to the quality of gas and character of the district with which the administrators of the Company have to make their account. It has not yet dawned upon the opponents of the Company that, while they can make gas, they are not responsible for making Dublin; and that Parliament will not be influenced, in determining what is a fair price for gas in Dublin, by any consideration of what the same commodity can be supplied for in any number of places selected from the entries in the Board of Trade returns.

The "Lancet" Report on the Welsbach Light.

THE report of the Special Analytical and Sanitary Commission appointed by the *Lancet* to examine the incandescent gas burner from the point of view of hygiene, an abstract of which will be found in another column, fully establishes the sanitary reputation of this fashionable system of gas lighting. Henceforthward it may be hoped that no more will be heard of the jealous attempts of electricians, who are paying the Welsbach light the high compliment of fearing it, to make out that these burners give off poisonous products of combustion. It is not the least interesting feature of these *Lancet* reports upon such subjects of sanitary inquiry as gas burners and stoves, that they bear upon their face the imprint of non-technical authorship. As with the earlier report upon gas-stoves, so in the present case, the *Lancet* Commissioners indulge in observations respecting coal gas, its manufacture and uses, which would certainly not occur to the mind of a gas expert. But this is in one sense all the better for their credit—at least on the score of impartiality. We may take it that our medical contemporary saw in the incandescent gas-burner a novelty of great and growing popularity, and, knowing that aspersion

had been cast upon its healthfulness, at once set to work to fully investigate the matter in a scientific way. The first point to be determined by them was the nature of the apparatus; and nobody will question the description applied to it as "consisting simply of an ordinary "Bunsen burner, over the flame of which is suspended a "network of incombustible material that is intensely light-"giving when raised to the temperature of the Bunsen "flame." The phraseology is slightly awkward, but the meaning is correct. Now, the products of combustion of a given quantity of gas in air must be the same in whatever way the gas is burnt. It cannot make the slightest difference in the bulk of these combustion products, whether the gas is burnt "neat" or mixed with a proportion of air—always assuming the process of combustion to be complete. If the amount of the combustion products is calculated with reference to the lighting effect obtained from the gas, then, of course, this will be least, light for light, with the most efficient lighting burner. The question next arises as to whether combustion is really complete in any particular case; because, if this condition is not fulfilled, the nature of the combustion products will be altered. With burners consuming their gas "neat," such as the Argand or the flat-flame burner, combustion is, in the ordinary way, complete; so that we should not expect to find any products due to imperfect combustion, such as unconsumed carbon, carbon monoxide, or acetylene, in the atmosphere of a closed apartment lighted by their agency. When, however, an open flame of either of these classes is forced beyond its proper burning capacity, or turned so low as to be chilled by a neighbouring conductor of heat, or blown about by draughts of air, the results of imperfect combustion would necessarily be forthcoming. In the case of the Welsbach burner, there occurs a complication of phenomena which is not found in the ordinary luminous burner. It is composed of an atmospheric gas-flame and a refractory mantle rendered incandescent by the former; and it becomes an interesting question as to how far, if at all, the latter affects the combustion products of the former. If the mantle were of heavy, substantial texture, it might be expected to interfere with the combustion of the gas impinging upon it; and the result would be the exhibition of the familiar effects of interfering with this operation. The fact is, however, that the material composing the Welsbach mantle is so distributed and so comminuted, and takes up heat so readily, that it assists rather than interferes with the combustion of the gas; thus exerting a concentrating action which the *Lancet* Commissioners have been able to detect and certify. There is no difficulty about this conclusion, which results simply from observation of the combustion effects of gas consumed in a Welsbach burner with and without the mantle which renders it luminous. When next our electrical contemporaries devote their columns to diatribes against incandescent gas-burners, perhaps they will shift their abuse from the sanitary to some other ground.

The Conference of the Miners' Federation.

THE Miners' Federation have been holding a conference in Birmingham during the past week, under the presidency of Mr. B. Pickard, M.P.; and the usual "business" of speechifying, passing resolutions, and making arrangements for the holding of future congresses, international and otherwise, kept the delegates occupied during several days. The conference approved the new standing orders framed by the Parliamentary Committee of the Trade Union Congress, and thought it would be a very nice thing for the Federation to have a newspaper of its own. It would indeed be a good thing if coal miners and all other Trade Unionists had a reliable trade journal, to which reference could be made for information respecting the desires and doings of the workers themselves, and not merely of their professional "leaders." Mr. Pickard's Inaugural Address has been very much criticized by the newspapers for its evidences that a Trade Union chief, like the Bourbons, can neither learn nor forget anything. He mentioned the disastrous Scotch miners' strike and its consequences without indicating that he has any sense of the responsibility attaching to those who promote and mismanage such outbreaks. His references to Lord Shand were not particularly gracious; and he did not think it worth while to explain why the Federation failed to obtain a footing in Wales. Altogether, Mr. Pickard succeeded in glozing over the many incidents that have occurred of late to indicate that the interests of the mining population would not conspicuously suffer if the Federation were to drop out of existence, and its politicians and agitators be reduced to work instead of talk and pose for their living. This must be counted to him for cleverness, of a kind.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 137.)

THE course of movements in the Stock Markets during the past week was somewhat irregular; and no very marked or pronounced tendency was developed, except in a few special quarters. At the opening, things looked brighter in general. But they soon began to fade, when profit-snapping became the rule; and, by the middle of the week, they were quite flat. A recovery, however, set in later on; and, in many instances, prices closed at a rise. Consols are still steadily rising, and were marked at 104⅜ on Friday. Even the depressed Americans picked up a little. The Money Market remains quite unaltered; and the excess of supply over demand is so great as to defy the possibility of being affected by any contingent requirements. Business in the Gas Market has been much more abundant than in any week for a considerable time past; and the tendency of prices to rise has been accelerated by the universal demand for investment securities of good character. Advances in quotations are thus numerous and considerable. Conspicuous beyond all the rest, Gaslight "A" had a rise every day of the week but one; and, after opening with a mark of 257, was done at 267 on Saturday. It thus starts on the new year with a 4½ per cent. for money value. The meaning of this advance will be more apparent when the accounts come out. The secured issues were not particularly active; and their prices were not remarkable. South Metropolitans were quiet. But a few lots changed hands at good figures; and the quotations of "A" and "B" increased. The former also attains a 4½ per cent. price. Nothing was done in Commercials; but the quotation of the old stock was put up. Very few transactions were recorded in Suburbans and Provincials; but those few showed great firmness, though British was the only one to move. Renewed activity was the rule with Continentals, especially Imperial; and they all made nice improvements. Among the more remote undertakings, Chicago bonds advanced; but Buenos Ayres was a little flatter. Business in the Water Companies was well up to the average. All were very firm; and two or three of them improved on their opening quotations.

The daily operations were: The opening day was promising in the Gas Market; business being livelier and prices good. Gaslight "A" rose 1. On Tuesday, the favourable tendency was maintained. Gaslight "A" and Imperial Continental rose 2 each; and Chicago first bonds, 3. Wednesday was much the same; the general position being unchanged, except for a further advance of 2 in Gaslight "A." Thursday was more active; and many quotations improved in value—the Metropolitan Companies being conspicuous. Gaslight "A" rose 1; South Metropolitan "A," 3; ditto "B," 1½; Commercial old, 3; Continental Union, 1½; and European, ½; but Buenos Ayres fell ½. In Water, Southwark ordinary gained 1. Business remained as good on Friday; but the only move was a rise of ½ in British. Lambeth Water went up 1. Saturday was fairly active and firm. Gaslight "A" rose 3; and Chicago second bonds, 3. New River also improved 3.

ELECTRIC LIGHTING MEMORANDA.

Board of Trade Inquiry into the St. Pancras Electrical Culvert Explosion—Mr. R. E. Crompton on Electricity Supply—An Alarming Prediction—The Liverpool Corporation and the Electric Supply Company; a Proposal to Purchase.

THE Board of Trade inquiry into the circumstances and probable causes of the Endsleigh Gardens culvert explosion was held by Major Cardew last Thursday, and terminated without adding much to what was previously known of the affair. Several witnesses described the upheaval of the paving stones; and the injured passers-by narrated their unpleasant experience in connection with this local earthquake. But these statements did not throw any fresh light upon the genesis of the eruption. Certain officials representing the Electric Lighting Department of the St. Pancras Vestry tried their utmost to bring in coal gas guilty of the whole mischief; but their efforts in this direction only succeeded in putting it upon record that the presence of gas had been occasionally noticed in some of their conduits, and that they had consequently been constrained to keep a regular watch upon the manholes. Professor Robinson some time ago made himself responsible for a vague declaration as to the adoption of some special ventilating arrangement in connection with the St. Pancras electrical distributing plant; but although repeatedly twitted on the subject by the electrical journals, he has never divulged the nature and operation of his method. It certainly does not appear, from the report of the proceedings before Major Cardew, that this so-called ventilation system amounted

to anything more, practically, than a periodical removal of the manhole covers, and a sniffing for gas by the natural organs of the servants of the Vestry. The statement made on behalf of that body at the inquiry, that nothing was found to be the matter with the conductors in the Endsleigh Gardens circuit, rather aggravates than diminishes the gravity of the occurrence, as the *Electrician* candidly admits. For when an explosion occurs, as in the Cannon Street case, as a consequence of some mistake or carelessness on the part of an operative, one knows how a repetition of the disaster may be brought about, and perceives how to guard against it. But when there is an electrical earthquake in a quiet thoroughfare, and nothing can be adduced to account for it, what satisfaction can be given to the natural curiosity of the public with regard to it? The Gaslight and Coke Company maintain their absolutely correct and prudent attitude in respect to these disquieting occurrences. The electricians came to the gas, not gas to the electricians; and it is for the new-comers to keep clear of it. The Company's officers will assist the Board of Trade and the electric lighting interest in devising means for assuring the public safety. But, after all, it is those who bring a light into places where no light should be that provoke gas explosions; and even so it does not necessarily follow that the gas which explodes in electrical conduits is coal gas.

Mr. R. E. Crompton, the newly-elected President of the Institution of Electrical Engineers, delivered his Inaugural Address to the members of the Institution on Thursday last. As was to have been expected, this composition was of a highly interesting character, especially that part of it which was devoted to the discussion of the question of the "load factor" in central station working. This clever means of exhibiting the paramount influence in central station development was the suggestion of Mr. Crompton himself; and he still handles it with supreme skill. He admitted on Thursday that the disparity between the winter and summer supplies of electricity would always exist, so long as the principal use of electricity was for lighting. Nothing analogous to the gasholder is in sight of the electric lighting industry; and therefore Mr. Crompton urges that the next best resource of electricians responsible for the economical working of central supply stations is to educate the public into using electricity for motive power and for cooking and heating. He went on to say that one use to which electrical energy could be applied in very considerable quantities in residential districts is the production of artificial cold by means of electric motors. Far be it from us to discredit Mr. Crompton's observations on such subjects, or to deny to electric lighting undertakings such comfort as they can derive from his assurances as to the utility of electricity in its newly-assigned part of common drudge to the aristocratic patrons of the West-end supply companies. Electricity may cook the dinners, cool the wines, ventilate the rooms, and warm the boots of the dwellers in Mayfair and Kensington, as Mr. Crompton predicts of it; but he seems to overlook the point that in doing all this it will not tend to reduce, but rather to heighten, the peak of the terribly uneven daily load diagram for such neighbourhoods. For these people dine late and receive late, as the suppliers of gas to fashionable localities know full well. The part played by a gas cooking-stove in Mile End differs radically from that performed by a similar appliance in Mayfair. Where people dine in the middle of the day, and hardly use the gas-stove afterwards, it helps a gas company to an increased day consumption; but when it is only required for the preparation of a late dinner, at an hour when the full lighting load is on, it is no particular help to the company, and certainly would not deserve to be supplied with gas at a cheaper rate than is chargeable for the lighting service.

In concluding his address, Mr. Crompton uttered a note of warning which will not form pleasant reading for some local authorities. He remarked upon the extent to which ratepayers' money is being spent upon municipal electric lighting ventures; and he asserted that a good deal of this has been entrusted to the control of engineers whose experience is but short. There has been hurry in the adoption of systems and the selection of plant; local and special requirements have been insufficiently studied; and, consequently, Mr. Crompton is convinced that there is trouble in store for many venturesome local authorities. He thought that in many cases "failure in part or in whole would follow; and then a reaction would set in which would damage the interests of the profession almost as much as the speculation in electric light companies' shares in 1882." One can imagine the town councillors of certain places that might be named looking somewhat blankly into one another's faces after reading these forebodings, and hardly daring to ask whether they apply to their own pet scheme. Of course, those municipalities who have been equipped for the electric lighting business by the Chelmsford firm need not trouble themselves upon this score.

Some controversy has arisen in municipal circles in Liverpool over the recent policy of the Corporation in regard to electric lighting. As will be seen by our report elsewhere, the Lighting Committee of the Corporation have advised the Council to make an offer to the Liverpool Electric Supply Company, Limited, to buy up their undertaking as a going concern, during the current year, instead of waiting until the opportunity for so doing would present itself according to the statute; and the recommendation has been accepted. The prime mover in this business is Alderman Smith, and the proposal can only be interpreted as a high compliment to the Electric Supply Company. Unfortunately, the worthy Alderman's speech in moving the adoption of the Committee's recommendation did not contain anything to prove that the proposed purchase would be a prudent measure for the Corporation to take, in the estimation of anyone who was not already convinced of it. Alderman A. B. Forwood met his colleague's harangue with many words of truth and soberness; but, unhappily, the matter appears to have been more of a political than an economical question, and was therefore not decided upon its merits. At any rate, the decision was formed in haste; and it remains to be seen whether the proverbial result will follow at leisure.

Mr. W. Yawdrey, M.Inst.C.E., the Engineer of the South Staffordshire Water Company, died on the 2nd inst., after an illness of about three months' duration. The deceased gentleman had held the above appointment for thirty years.

The German Gas Journal.—Our esteemed contemporary the *Journal für Gasbeleuchtung* enters with the present year on a new phase in its career. It is now published weekly instead of three times a month. Prior to July, 1884, it only appeared twice a month; and we congratulate its sponsors on its sure and steady advance, which is indeed indicative of similar progress in the gas industry.

Mr. Robert Barrett has been appointed Manager of the Clitheroe Corporation Gas-Works, the duties of which office he undertook at the time of the death of Mr. W. Miles (whose assistant he was), which was announced in our columns on the the 25th ult. There were 95 applicants for the appointment, which was advertised in the JOURNAL; and Mr. Barrett was selected by the unanimous vote of the Council.

Death of Mr. G. E. Ledger.—We regret to record the death of Mr. G. E. Ledger, Manager of the Tewkesbury Gas Company, Limited. Mr. Ledger went to Tewkesbury from Matlock Bath not quite three years ago, to succeed the late Mr. John Surl. He was of very delicate constitution, and many feared, soon after he arrived there, that his strength would not prove sufficient for a long occupancy of the position he had taken. He was most courteous and obliging, and an experienced manager; and by his decease both the Company and their customers have again, after a comparatively brief interval, to face a very unwelcome change. Mr. Ledger has left a widow and two children.

The Late Mr. Robert Jones.—In the notice of the work of the late Mr. Robert Jones which appeared in the JOURNAL last week, we omitted to mention that he was adviser to the old Birmingham Gas Company for a short time before the transfer of the undertaking to the Corporation; and he valued it, as well as that of the Birmingham and Staffordshire Gas Company, when the works were acquired by the Municipality. He was then in constant communication with the Right Hon. Joseph Chamberlain, who, it may be remembered, negotiated the transaction with the Companies. Mr. Jones was for many years a member of the Metropolitan Board of Works; resigning the position two years before the Royal Commission sat which terminated the existence of that body.

The Accident to the East River Gas Company's Large Holder.—In the JOURNAL for the 18th ult., a correspondent called attention to a report in the *New York Herald* of a very serious accident sustained by the four-lift holder in course of erection by the East River Gas Company, in the severe gale which swept across Long Island on the 10th of October last. In the same issue, we gave a general view of the Company's works, showing the holder in question; accompanying it by some particulars reproduced from a description of the works which had previously appeared in our columns. As the holder was about 200 feet high, and, according to report, had guide-framing "extending to the top of the second lift only," our correspondent expressed alarm at the danger threatened to gasholders in this country constructed without any guide-framing whatever. The succeeding number of the JOURNAL contained a letter from Mr. G. Livesey on the subject, in which, in view of its importance to the gas industry, he suggested that the Contractors, or some American friends, should furnish full particulars of the occurrence, for the information of their colleagues on this side of the Atlantic. In the event of the desired information not being forthcoming, he suggested an independent investigation. An advance proof of this letter, with our editorial comments thereon, was forwarded to the Contractors (Messrs. R. D. Wood and Co., of Philadelphia), who on the 1st inst. cabled to us to defer the publication of the letter as full details were not, they said, at the command of the writer when it was indited. Of course, this could not be done, as the letter had then been in our readers' hands for a week. We have since received a communication from Messrs. Wood, in which they state that only *one* of the four lifts of the holder was to rise above the framework. The holder was not fully completed; so that the investigation suggested by Mr. Livesey would really throw no light upon the modern methods of constructing gasholders. They add that they will be pleased to send us early details of the holder, as well as of the accident to it, when it is finished; but they consider it would scarcely be proper to do so at the present time, as they have not yet settled with the Gas Company.

GAS BILLS FOR 1895.

ACCORDING to custom, we give a summary of the proposals of the Private Bills relating to gas supply which await the attention of Parliament.

Three Bills are for the incorporation, with statutory powers, of gas companies. The Hayward's Heath Gas Bill is to incorporate a Limited Liability Company formed in 1865, who have an actual share capital of £6500, of which £6000 is paid up, and have borrowed on debentures £2400, and £400 on a promissory note. The proposed limits of supply include certain portions of the parishes of Cuckfield and Lindfield, and neighbouring parishes, in Sussex. The proposed capital is £50,000, whereof £6000 is to be the original capital, and the rest additional 7 per cent. capital, to carry the usual borrowing powers. A clause is inserted relieving directors from disqualification on account of their holding other office under the Company, or becoming interested in a contract with the Company. Interest at the rate of 5 per cent. per annum is to be paid on consumers' deposits; and prepayment may be demanded in certain cases. The proposed standard price for 14-candle gas is 5s. per 1000 cubic feet; and discounts of not exceeding 10 per cent. are to be sanctioned. A clause limiting to the current quarter the period of error in defective meters, is inserted in the Bill; and also a clause to enable the Company to make contracts for the supply of gas for public purposes for periods of not exceeding seven years. Additional gas lands are to be acquired compulsorily. The Newmarket Gas Bill is to incorporate the Victoria (Newmarket) Gaslight and Coke Company, constituted by Deed of Settlement in 1840, and registered as a Limited Company in 1865. The present capital consists of £30,000 of ordinary stock, fully paid up; and there is no mortgage debt. Dividends at the rate of 10 per cent. and upwards have for many years past been paid upon this capital. The district of supply is to be such part of the counties of Cambridge and Suffolk as is situate within a radius of five miles from the Newmarket Town Hall. The new Company is to be called the Newmarket Gas Company, with capital arrangements as follows: From and after Sept. 18 next, £30,000 ordinary stock of the Limited Company shall be converted into £60,000, to be called original consolidated stock, with a dividend at the standard rate of 5 per cent. per annum. To this amount is to be added £20,000 of additional 7 per cent. capital. Borrowing powers are desired to the extent of £7500 in respect of the original, and £5000 in respect of the additional capital. The Company's Auditors need not be shareholders. Additional gas lands are to be acquired compulsorily. The initial price of 15-candle gas is put at 4s. 8d. per 1000 cubic feet, with a sliding-scale adjusted to the different classes of capital. Interest at the rate of 4 per cent. is offered on consumers' deposits. Power is desired to apply for an Electric Lighting Order. The North Middlesex Gas Bill is to incorporate a Limited Company, constituted under a Memorandum of Association dated in 1862, for the purpose of supplying gas in the parishes of Finchley and Hendon, Middlesex, with a capital of £15,000. The Company obtained a Provisional Order in 1871, and a second Order in 1876, by which they were authorized to raise additional share capital not exceeding £30,000, and to borrow moneys not exceeding in the whole £11,250. The present share capital consists of this £45,000, all paid; and the full borrowing powers have been exercised. The district of supply is defined. The capital required is £100,000, whereof £45,000 is to be the old capital, and the balance new 7 per cent. capital. Only the original £15,000 is to receive the full 10 per cent. dividend. The usual borrowing powers are desired. Additional lands are to be compulsorily acquired. A maximum price of 4s. 9d. per 1000 cubic feet is asked for 14-candle gas. Interest at the rate of 5 per cent. is offered on consumers' deposits; and prepayment may be required in certain cases. The period of error in defective meters is to be limited to the current quarter; and seven years' contracts with public authorities are to be sanctioned.

Four Incorporated Gas Companies have Improvement Bills. The British Gaslight Company, Limited (Staffordshire Potteries), Bill is to empower the Company to expend further capital at their Potteries station. It is provided in the existing Acts that the capital to be so laid out shall not exceed the sum of £122,610, the whole of which has been spent. It is now desired to apply £80,000 more for the same purpose, whereof £60,000 is to be capital stock, and the balance borrowed money. All the additional capital, howsoever raised, is not to cost more than 5 per cent. The Ilfracombe Gas Bill is to extend the limits of supply to comprise the parishes of Morthoe, West Down, Bittadon, Berrynarbor, and Combmartin; to enable the Company to acquire additional gas lands compulsorily; and to convert and increase their capital. It is proposed that, as from June 30 next, the capital of the Company shall be a sum not exceeding £23,510 16s. (subject to increase); and the existing share capital is to be converted into fully-paid stock not exceeding that amount, whereof the sum of £15,750 is to rank as preference stock bearing a perpetual dividend of 5 per cent., and the balance is to be 5 per cent. consolidated ordinary stock. The method of distributing these stocks is set out in detail. Additional ordinary stock to the amount of £76,000 is required, with borrowing powers in the usual proportion. Authority is sought for constructing a new road and seawall on Hele Beach, with the object of reclaiming a portion of the foreshore. Detailed provisions are inserted for dealing with displaced householders of the labouring class, and with regard to other interests affected by the projected reclamation. The Scarborough Gas Bill is to confer various powers on the Company, mainly in respect to capital. The existing capital consists of £20,000 of consolidated original ordinary stock, fully paid, created under an Act of 1851, entitled to 10 per cent. dividend; £30,000 consolidated new stock, fully paid, created under an Act of 1859, entitled to 7½ per cent. dividend; £27,343 preference stock, fully paid, created under an Act of 1867, entitled to 5 per cent. dividend; £12,657 new ordinary stock, fully paid, created under the Act of 1867, entitled to 7 per cent. dividend; and £60,000 new ordinary stock, created under an Act of 1873, entitled to 7 per cent. dividend, on which the sum of £57,000 has been paid; and the Company have raised on mortgage £35,750, but have not created debenture stock. It is desired that the Company may be empowered, with the consent of three-fourths of the holders, to convert the whole or any part of the ordinary stock and shares into an equivalent amount of 5 per cent. consolidated ordinary stock. More 5 per cent. capital to the amount of £79,000 is asked for, to carry the usual borrowing powers. Additional gas lands are to be purchased compulsorily. The maximum price for gas is to be 4s. per 1000 cubic feet within, and 5s. outside the borough. Discounts not exceeding 10 per cent. may be allowed. The period of error in defective meters is limited to the current quarter. A clause proposes that "any consumer intending to discontinue his supply shall give 24 hours' written notice to this effect; and in default shall be liable to pay for all gas registered up to 48 hours after the receipt of such notice." The South Metropolitan Gas Bill has already been noticed in the JOURNAL; but it is desirable that it should be included in this list. It proposes to convert the existing stocks of the Company into £4,425,000, whereof £2,140,000 are to be deemed fully paid up, and the remaining £600,000 unissued "C" stock into ordinary stock—all bearing a uniform standard 5 per cent. dividend. New issues may be offered to consumers and employees of the Company at not less than the average market price. The purchase money of all stock is to be paid within one month. The Directors' qualification is put at £4000. The standard price of gas is to be re-enacted at 3s. 6d. per 1000 cubic feet; and the dividend on the consolidated stock is to go up or down 2s. 6d. per cent. for every penny reduction or increase upon this standard. A schedule to the Bill contains regulations as to nominations by employees to transfer stock, according to a clause which proposes that any employee-stockholder aged 16 and upwards may nominate any person to transfer such stock at the holder's death. Provision is also made for dealing with the deposits of deceased stockholders under the Company's profit-sharing scheme.

There are four Bills for authorizing the transfer of gas undertakings from companies to local authorities. The Ambleside Local Board (Gas and Water) Bill is to enable the Local Board to acquire the gas-works belonging to the Ambleside District Gas and Water Company, for such price as may be agreed upon between the parties or ascertained by arbitration. With the latter prospect in view, it is proposed that the Arbitrators shall value the gas and water undertakings separately, and shall have regard to the nature of the Company's interest in the lands held by them for the purpose, and shall set forth in the award the number of years' purchase, and the allowances and depreciations due in the case, taking into account all the circumstances, and the condition of the undertaking. The limits of supply are defined in the Bill. Additional lands are to be acquired compulsorily. The maximum price of 15-candle gas is put at 5s. 6d. Interest at the rate of 4 per cent. is offered on consumers' deposits. Consumers removing are to give 24 hours' written notice, and in default to be liable for gas registered by their meter up to the next usual period for index-taking. Provision is made for sales of portions of the undertaking to other local authorities. Power is sought to borrow the ascertained value of the gas-works, and £9000 in addition. The Brighouse Corporation Bill is to authorize the sale of the undertaking of the Rastrick Gas Company to the Corporation, in accordance with the terms of an agreement entered into between the Company and a Committee formed for the purpose of promoting the incorporation of the town, which took place by Royal Charter in 1893. The purchase-money is to be £47,500; and the debenture debt, amounting to £2800, is to be paid by the Corporation. The reserve fund, amounting on Dec. 31, 1891, to £1956, is to be retained by the Company. The sale and purchase is to be deemed to take effect from Dec. 31, 1891; and the sale is to be completed on June 30 next, or one month after the passing of the Bill, whichever shall last happen. For the interim period since 1891, the undertaking is to be regarded as having been carried on by the Company on behalf of the Corporation. The maximum price of gas is put at 5s. per 1000 cubic feet; and the illuminating power, at 15 candles. Interest at the rate of 3 per cent. is offered on consumers' deposits. The district known as Hove Edge is to be taken out of the gas limits of the Halifax Corporation, and included in those of the borough. The sum of £53,000 is to be borrowed for the acquisition of the gas-works, and £30,000 for their enlargement and improvement. The Chesterfield Gas and Water Bill is to constitute and incorporate a Gas and Water Board for the borough of Chesterfield

and the neighbouring districts of Whittington and Newbold and Dunston, to take over the undertaking of the Chesterfield Water-Works and Gaslight Company, upon terms to be ascertained by agreement or arbitration. Besides the cost of purchase, the sum of £30,000 is required for gas purposes. Surplus gas profits are to be applied to reducing the price of gas.

The Clonmel Corporation Bill is to provide for the transfer to the Corporation of the undertaking of the Clonmel Gas Consumers' Company, Limited, in accordance with the terms of a scheduled agreement, which fixes the consideration at the sum of £13,000, which is not to include the reserve fund or any cash in the hands of the Company. The present Manager is continued in office with a 15 years' engagement; and the Secretary and Bookkeeper each with a five years' engagement. The gas limits are to be the borough and a radius of two miles from the Town Hall. The maximum price of 7s. per 1000 cubic feet is put for 14-candle gas. The sum of £18,000 is to be borrowed for gas purposes. The Dublin Corporation Bill contains clauses to enable the Board of Trade to appoint Gas Referees for Dublin, and defining their powers in regard to testing gas. Gas examiners are to be appointed to make daily tests with either the Letheby open 60-inch, or improved Evans enclosed 100-inch photometer and the special burner prescribed in the Alliance and Dublin Gas Act, 1874. The average of all daily tests at a given place is to be deemed to represent the illuminating power of the gas at that place. The standard price for gas supplied by the Company is to be such as the Corporation shall prescribe; not being less than 3s. 4d. per 1000 cubic feet. A copy of the Company's accounts is to be supplied to the Corporation before audit, with power reserved to them to appear before the Auditor. The Company are not to be entitled to inspect or test any part of the lighting apparatus used by the Corporation without giving four hours' notice. The Hebden Bridge Local Board (Gas) Bill is to authorize the transfer of the undertaking of the Hebden Bridge Gas Company to the Hebden Bridge District Local Board. The capital of the Company now consists of £13,670 stock bearing a maximum 10 per cent dividend, and £16,424 with a 7 per cent. dividend. The Company were promoting a Bill in Parliament last session, and were opposed by the Local Board and the Mytholmroyd District Local Board. As a result, an agreement for purchase was entered into; and this agreement the present Bill seeks to confirm so far as it relates to the transfer of the undertaking to the Local Board. The scheduled agreement recites that the consideration for the purchase is to be the payment of a sum equal to 27 years' purchase of the maximum dividends actually paid by the Company. The maximum price of 4s. 6d. per 1000 cubic feet is put upon the gas, subject to specified discounts. The Local Board desire to borrow £103,000 for gas purposes. The Hebden Bridge and Mytholmroyd Gas Board Bill is to constitute a Board for the purchase of the gas undertaking proposed to be dealt with by the last-mentioned Bill. The chief difference appears to lie in the kind of new proprietary of the gas undertaking proposed to be set up; the present measure being for the constitution of a Joint Gas Authority composed of seven members of the Hebden Bridge District Local Board and two members of the Mytholmroyd District Local Board, in which case the surplus profits of the undertaking would either be applied to reduce the price of gas or be divided between the two Local Boards. The Rotherham Corporation Bill contains proposals for extending the gas lands of the Corporation; for changing the test-burner to a Sugg's No. 1 "London" Argand; and for stopping up a thoroughfare passing through the gas and water works. The sum of £20,000 is to be raised for gas-works purposes.

THE IMPROVEMENT (?) OF PORTLAND CEMENT.

Much interest has been aroused among buyers and users of Portland cement by the proceedings in connection with a meeting of cement manufacturers at the Cannon Street Hotel on Nov. 12, last, called, on the initiative of Messrs. Knight, Bevan, and Sturge, with the object of forming an Association of English Cement Manufacturers, the members of which should sign a statutory declaration to the effect that they had not been in the habit of adding to the calcined product of the kiln a separate supply of "raw Kentish rag stone or other stone, furnace or oven ashes, disused or exhausted fire-bricks, or any other material." We have received a printed report of these proceedings, which contains an explanation of Messrs. Knight and Co's action in the matter that is deserving of some notice. It appears that this firm directed Messrs. Renshaw, Kekewich, and Smith, solicitors, to address a circular-letter to their fellow manufacturers, stating that "it is becoming notorious that several manufacturers of English Portland Cement are largely adulterating their manufacture by the mixture of Kentish rag stone, other stone, furnace or oven ashes, disused or exhausted fire-bricks, or other inert material, and so bringing disrepute upon the good name English cement has hitherto borne in comparison for quality with cement of foreign manufacture." And the recipients of the letter were asked whether they would consent to join the proposed "pure cement" Association. The matter was gone into at the meeting already mentioned, when Mr. Bevan presided, and made a speech strongly condemning what he called the adulteration of cement in the manner described in the circular. Mr. Bevan's views on the subject were strenuously contested by Mr. Holt (Messrs. Macevoy, Holt, and Co.), who declared, after two years' experience of the use of Kentish rag stone with cement, that, instead of being an adulteration, "it is a vast improvement to the old original article;" and he observed that the action which Mr. Bevan desired the manufacturers to take would be tantamount to putting a barrier in the way of all future progress in the cement manufacture. As to the Kentish rag stone, Mr. Holt stated that not an ounce of the material was sent out by his firm until after a six months' trial, during which it was tested both chemically and in every other possible way. Upon this experience, he declared that the new admixture is an absolute improvement to cement. "It improves the cement in point of colour, and in its tensile strain; the sand tests are higher; and in every possible way it is a better article." Mr. Holt then gave particulars of tests in support of his contention; showing that "at seven days we had a test of 492 lbs.; at three weeks, 556 lbs.; at seven weeks, 656 lbs.; at three months, 740 lbs.; at eleven months, 1000 lbs.; and at twelve months, 1010 lbs. And with regard to the sand tests (three and one), we had in nine months 410 lbs., and another of 460 lbs." The speaker went on to point out that there is no specific law that Portland cement is to be made from chalk and clay only; and he concluded by declaring that, so long as the tests and the customers are satisfied, he does not propose to submit to the judgment of anybody in the trade. Mr. Porter followed on the lines that those makers of cement who do not mix their product should be protected from the "undue advantage" obtained from those who do; and that the matter should be dealt with by the London Chamber of Commerce. Mr. Holt seconded the latter proposal; and it was supported by Mr. Leedham White (John Bazley White and Brothers, Limited), who argued against the proposed Association, on the ground that it would tie the hands of the British cement manufacturer—especially with respect to the export trade—if he were not left free as at present, to manufacture cement in any way he pleases, subject to the paramount requirement of its satisfying the purchaser. "If," said Mr. White, "a manufacturer supplies cement subject to tests, and subject to analyses, he has fulfilled his legal obligations if his cement satisfies those tests and satisfies those analyses. And if he goes beyond that, as I contend a manufacturer ought to do, and supplies cement which will, according to the best of his judgment, give enduring satisfaction, apart from tests—and I might say sometimes in spite of tests—and apart from analyses, that manufacturer has completed and has fulfilled his full moral duty." Other manufacturers supported the general contention that if Portland cement can be improved, or cheapened without being deteriorated, by admixture of other materials than the traditional chalk and clay—if, in short, there is any advantage in these admixtures, the trade ought to look after and appropriate it. Others objected to the proposed statutory declaration because it was purely retrospective; while to some this appeared as its chief recommendation. Eventually, certain firms signed the declaration; but the whole matter has formed the subject of animated correspondence in *The Times*. The question is one between cement manufacturers and their customers. If the latter choose to prescribe the composition of cement as well as the tests of its binding quality, permanence, and fineness of grinding, the manufacturers will doubtless obey their instructions; but engineers are not likely to accept the propositions that there is no possibility of improving cement, or that users of the article need no other assurance of its quality than that it is made from chalk and clay. Nevertheless, engineers will not lose sight of the truth enunciated by Mr. H. K. Bamber, who states in *The Times* that "extraneous matters added to the cement clinker at the time of grinding only can never be Portland cement, and the results are only admixtures for the sake of cheapness, not for improving the cement, which is only effected by the finer grinding."

Incandescent Gas-Burners for Street Lighting.—The old flat-flame gas-burners have been found quite inadequate to properly light the streets of Dortmund, where the standards had originally been erected at too great distances apart. The defective lighting was especially evident on Sunday evenings, when the shops were closed. An endeavour has recently been made to bring up the lighting of some of the principal streets to as nearly as possible what is deemed a proper standard. It was considered that the streets should be so lit that print could be deciphered and features recognized in the darkest parts. The minimum light which met such requirements was that of one candle placed at a distance of 39 inches. With lamps 27 yards apart, a light of 80-candle power, at a height of 10 feet from the ground, gave this ideal illumination of places midway between two lamps. The nearest approach actually made to this desired standard was in cases where two incandescent gas-burners were fixed on each column, and the columns were 33 yards apart. The light midway between the lamps was only equal to two-thirds of a candle at a distance of 39 inches. Nevertheless each lamp gave five times the light of the discarded flat-flame burners, at an additional cost, according to a statement of Herr Reduer in the *Zeitschrift für Beleuchtungswesen*, of nearly 22s. a year.

NOTES.

The Duty of Steam Pumping-Engines.

Now that the high duty obtainable from coal used to develop power by the agency of the gas-engine is being generally recognized, it is desirable to bear in mind the capabilities of modern steam-engines. Professor A. B. W. Kennedy recently made a test of a Worthington pumping-engine constructed for the New River Company by Messrs. Simpson and Co., and erected at the Hornsey Sluice. The engine is triple-expansion, surface-condensing, and develops in ordinary working about 350 indicated horse power. It is supplied with steam by two Lancashire boilers, working at about 130 lbs. pressure per square inch. As a broad result of the trial, which lasted over twelve hours, the consumption of Nixon's Navigation hand-picked coal, free from small and slate, was after the rate of 1·34 lbs. per indicated horse power per hour, corresponding to the exceptionally high duty of 139,500,000 foot-pounds per hundredweight of coal, and to a steam consumption of 14·2 lbs. per indicated horse power per hour. The efficiency of the boilers was 80·4 per cent.; the mechanical efficiency of the engine, 84·4 per cent.—altogether a splendid result.

The Relation of Wind Velocity and Pressure.

It appears from a report in *La Nature*, that the Eiffel Tower in Paris is being utilized as a means of making dead-weight tests of wind pressures. M. Kœchlin has devised a system for measuring the force of the wind by the use of metal blocks, the resistance of which to overturning has been determined in the laboratory by means of blasts of compressed air. During the storm on the 12th of November last, the wind velocity anemometers registered a rate of 100 miles per hour; and according to the formula used for the conversion of velocity into pressure, the blocks indicating a pressure of 200 kilos. ought to have been overturned. As a matter of fact, however, only those indicating a pressure of 100 kilos. were displaced. From this, M. Kœchlin concludes that the formula gives results about 40 per cent. too high. It is remarked by *Nature* that these experiments afford a remarkable confirmation of Mr. W. H. Dines's recent investigations of anemometrical constants, in which he found that the usual theory of the cups moving with one-third of the velocity of the wind gave values which were 30 per cent. too high. Experiments very similar to those of M. Kœchlin were made by Mr. G. Dines some years ago, under less favourable conditions, but with nearly similar results.

The Synthesis of Chlorides of Carbon.

In a recent number of *Nature*, reference was made to a note concerning the synthesis of the chlorides of carbon (C_2Cl_4 and C_2Cl_6) during the preparation of carbon tetrachloride by the chlorination of carbon disulphide at low temperatures, communicated to the *Berichte* by Professor Victor Meyer. It is a well-known fact that, at a red heat, vapour of carbon tetrachloride is dissociated—a portion of the chlorine being liberated, and the two chlorides above mentioned being produced. It now appears that this change occurs to some extent at temperatures but slightly elevated above the ordinary. At the chemical works of MM. Müller and Dubois, near Mannheim, carbon tetrachloride is manufactured in large quantities by the chlorination of carbon disulphide at temperatures between 20° and 40°. Each operation is allowed to proceed for several days; and the completion is indicated when the liquid has become deeply coloured owing to the formation of sulphur dichloride (S_2Cl_2). The carbon tetrachloride is then distilled off, leaving the chloride of sulphur behind. Upon rectification of the carbon tetrachloride, a quantity of higher boiling oil is obtained, the nature of which Professor Meyer has investigated. Upon fractionation, it separates into three constituents—carbon tetrachloride (CCl_4), the liquid chloride analogous to ethylene (C_2Cl_4), and the solid chloride (C_2Cl_6), the so-called perchlorethane. Excellent crystals of the latter compound are at once obtained practically pure. That a real synthesis of these two latter compounds occurs during the manufacture of carbon terachloride at so low a temperature as 20° to 40°, is proved by the fact that the carbon disulphide employed is found to be quite pure, except for a mere trace of dissolved free sulphur. Professor Meyer considers that the two chlorides are produced in accordance with the equations—

$$2CS_2 + 10Cl = C_2Cl_6 + 2S_2Cl_2,$$
$$2CS_2 + 8Cl = C_2Cl_4 + 2S_2Cl_2.$$

A Method of Determining the Value of Quicklime.

Messrs. W. E. Stone and F. C. Scheuch suggest, in a contribution to the *Journal* of the American Chemical Society, the use of a sucrose method for determining the value of quicklime. It is remarked that the value of quicklime depends upon the amount of calcium oxide which it contains. This value may be diminished by the presence of other substances originating in the limestone, consisting usually of magnesia, alumina, silica, and iron; by incomplete burning in the kiln; and, lastly, by a partial slaking, through the action of the moisture of the air, by which a portion of the calcium oxide reverts to calcium carbonate. An analysis of quicklime, therefore, should show not only the amount of calcium present, in distinction from other elements, but should distinguish between the calcium present as oxide and that in other forms of combination. For this purpose, the authors propose to utilize the well-known solubility of calcium oxide in sucrose solutions. They take approximately 1 gramme of the finely pulverized material to be examined, and shake it well up with 150 cubic centimetres of a 10 per cent. sucrose solution during 20 minutes. The solution is then filtered, and the clear filtrate titrated with standardized hydrochloric acid of about one-fifth the normal strength—using tropœolin or rosolic acid as the indicator. The results by this method are slightly lower than those derived by the gravimetric method. It is claimed that by this means an entire determination of the active principle of quicklime may be made in half an hour, with a degree of accuracy quite sufficient for all ordinary purposes.

Institution of Civil Engineers.—At the monthly ballot for membership of this Institution last Tuesday, Mr. T. S. Platts, of the Odessa Water-Works, was elected an associate member.

Mr. Eli Bloor, a prominent Labour member of the Birmingham Corporation, died at Bournemouth, where he had been staying for the benefit of his health, on the 6th inst., in his 52nd year. Mr. Bloor was instrumental in securing a reduction in the hours of the men at the gas-works of the Corporation; and he also championed the cause of the scavengers in the service of the Health Department.

The Gas Tramway at Dessau.—With reference to the communication under the above heading in the JOURNAL for the 1st inst. (p. 22), we have received a letter from Herr von Oechelhaeuser, in which he asks us to state that, as it was not written by him, he does not wish to be held responsible for it, especially in regard to the comparison made with the electric cars. He says: "I indeed forwarded the article to you; but I omitted to mention that I was not the author, and should not agree with every detail therein. I shall make a full report after the gas tramway has been longer in use; so that the article must be regarded only as a preliminary notice on the part of the Company (the Dessauer Strassenbahn-Gesellschaft) who are the proprietors of the tramway."

The Russian Petroleum Trade.—For several months there have been unfavourable reports, says a contemporary, from the petroleum districts, both as regards the present trade and the prospects for the future. It looks as if the petroleum trade were gradually leaving those centres which have hitherto principally fixed the prices. The business, which was formerly confined to comparatively few places, is being split up; and markets are gaining for themselves a more and more independent position. This is, no doubt, an additional reason for the complaints which are heard from what used to be the principal centres. In the petroleum districts, the prices are increasing as the yield of the naphtha springs decreases. A depôt for the sale of petroleum has been established at Bornoul, in Siberia, whereby a new outlet has been created. Hopes are also entertained that Siberia may become an important producer of petroleum, as numerous springs have been found in the neighbourhood of the Baikal Lake. Rich springs have also been discovered at Kudako, some 24 miles from the Black Sea—a fact which has induced an American Syndicate to start a large industrial undertaking there. The Government are doing what they can to facilitate the export trade; and the rates of carriage on the Wladikoukos Railway have been reduced. Reductions in railway rates have also been made recently, with the view of better enabling Russian petroleum to compete with American in the Russo-Prussian border districts; the transport having been made 20 per cent. cheaper.

Explosive Mixtures of Acetylene and Oxygen.—Writing to *Nature* in reference to their note on the above subject, based on Professor Lothar Meyer's communication to the *Berichte*, reproduced in the JOURNAL for Dec. 18 (p. 1164), Professor Thorpe remarks that, while the thanks of chemists, and particularly of those whose duty it is to perform lecture experiments, are due to Professor Meyer for once more drawing attention to the dangerously explosive nature of mixtures of acetylene and oxygen, it may be assumed that the facts already known concerning acetylene account sufficiently well for the great violence of the explosion, and hence for the circumstance that the mixture will shatter even the open cylinder in which it is detonated. What M. Berthelot terms the "molecular rapidity" of the reaction, as distinguished from the rapidity of propagation, in the case of mixtures of acetylene and oxygen is very high. The heat of the reaction, too, is nearly five times as much as in the cases of electrolytic gas and of carbonic oxide, and more than twice as much as that of methane. It is slightly exceeded by that of ethylene; but, on the other hand, the theoretical temperature of the change with acetylene is enormously greater than in the case of any other explosive mixture of gases. The temperature, too, required to initiate the change is, as Professor Lothar Meyer showed indirectly some ten years ago, much lower in the case of acetylene than in that of the other gaseous mixtures of which he speaks. All the conditions tend to make the duration of the reaction so nearly instantaneous, that the initial pressure cannot be far removed from the theoretical pressure; and this is sufficient to smash a much stronger envelope than a glass cylinder even if the "tamping" be nothing more than the air. Professor Thorpe says everything we know about acetylene combines to show it is extremely "sensitive" as an explosive, and that in this respect, as in its destructive action, it resembles mercuric fulminate.

TECHNICAL RECORD.

THE PRODUCTION OF ACETYLENE FROM CALCIUM CARBIDE.

By Francis Wyatt, Ph.D.

[Prepared for the *Engineering and Mining Journal*, New York.]

If the problem of producing aluminium in great abundance, and at a sufficiently low cost, by direct reduction of clay, has not yet been satisfactorily solved, the immense amount of experimental work which has been done in the endeavour to solve it, from the time of Sir Humphry Davy down to our own day, has been amply repaid, not only by the vast increase which it has added to our knowledge and experience of electrical smelting, but by certain other developments of great industrial importance which well merit the attention of chemists and engineers. It has proved to us, for example, that, under the conditions of intense heat only obtainable in certain forms of electrical furnaces, the most refractory alkaline earthy metals may be deoxidized, and formed into definite and more or less stable compounds with carbon, as may be demonstrated by the equation—

$$CaO + 3C = CaC_2 + CO.$$

There is thus opened up to us quite a new field in industrial organic chemistry. It is true that these compounds have long been known to us; but it is equally true that they have not been produced commercially, for the reason that we have hitherto been unable to secure the intensity of temperature essential to their commercial production.

In the year 1836, a bye-product was obtained in the preparation of potassium, which decomposed water and gave off acetylene (C_2H_2), and which was found to be a compound of carbon and potassium. At about the same time, Wohler made carbide of calcium experimentally by subjecting to a high degree of heat an alloy of calcium and zinc mixed with charcoal; and he found that it could be used for the production of acetylene. There was nothing of industrial consequence, however, in these discoveries; nor does anything appear to have been accomplished to attract attention to the carbides until the early part of 1892, when L. Maquenne* prepared barium carbide (BaC_2) by heating in an iron bottle 26·5 grammes of barium carbonate, 10·5 grammes of powdered magnesium, and 4 grammes of charcoal. He kept the bottle in a Perrot furnace for four minutes, and found that the following reaction took place:—

$$BaCO_3 + 3Mg + C = BaC_2 + 3MgO.$$

The cooled mass was amorphous, bluish grey, and friable, and 100 grammes of it yielded from 5200 to 5400 c.c. of acetylene, mixed with some ⅛ per cent. of free hydrogen.

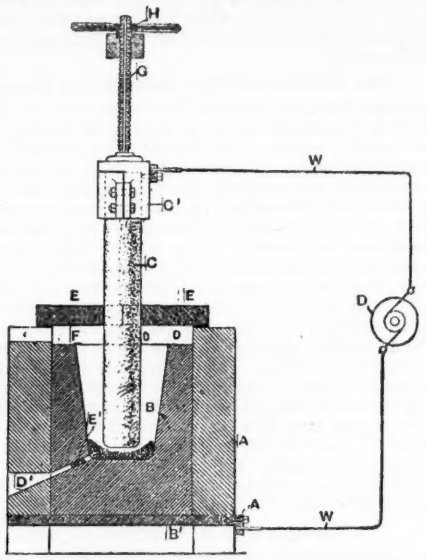
The curiosity awakened by these results led to further investigation; and in a short time W. Travers† devised another, although very similar, method of obtaining acetylene in comparatively large quantities. In place of magnesium, he used metallic sodium, and a mixture of powdered calcium chloride and dried gas carbon (1:4). After properly closing his iron bottle and heating it in a furnace to a red heat for 30 minutes, he removed and cooled it with water. The brittle bluish-grey mass when broken out was in this case found to contain about 16 per cent. of calcium carbide (CaC_2), with some free carbon and some chloride and cyanide of sodium; and it gave off acetylene in satisfactory quantity when thrown into water.

While Maquenne and Travers were working on these lines, Mr. T. L. Willson, of the Willson Aluminium Company, was carrying on experiments in the manufacture of aluminium and calcium alloys at Spray, N.C. In the progress of these experiments, and while attempting to produce metallic calcium in his patent electric furnace, he succeeded in making, from a simple mixture of lime and carbon, and with a current of 4000 to 5000 ampéres, a fused, black, homogeneous mass, which became solid and brittle when cooled. This substance was shown by analysis to be very pure carbide of calcium, of the formula CaC_2; and the gas which it evolved from the decomposition of water was pure acetylene, formed according to the reaction—

$$CaC_2 + 2H_2O = C_2H_2 + Ca(HO)_2$$

This contribution to organic chemistry of a plentiful and cheap source of acetylene, by so easy and simple a method of making calcium carbide, must be regarded as one of the most important of the valuable resources added to the chemical industry by electrical engineers; and the Willson Aluminium Company has shown its appreciation of it by continuing to manufacture the carbide on a small scale. A new corporation has also been formed, which is known as the Electric Gas Company, and which proposes to erect a large new plant for its wholesale production.

The electrical furnace that is to be used is shown in the accompanying illustration, and was invented and patented by Mr. Willson on Feb. 21, 1893 (No. 492,337); his application having been filed in August of the previous year. A is the outer masonry shell or bench of the furnace; B, the carbon or graphite crucible or hearth; C, the carbon bar or pencil constituting the moveable electrode; and D, the dynamo for generating the currents. From the terminal brushes of this dynamo, one wire, W, leads to and communicates with the crucible B; while the other, W^1, leads to and communicates with the carbon pencil. The connections are preferably made in the manner shown; the wire W being connected through a fastening bar A^1 to an iron plate B^1 underlying the crucible, and the wire W^1 being connected to a metal socket C^1 embracing the upper end of the carbon pencil. The bench is made preferably of fire-brick, which is a non-conductor of electricity; and the furnace is covered with a plate or preferably with two plates of carbon E, having a central hole through which the carbon pencil projects down into the crucible. For tapping out the resulting product, a tap-hole D^1 is formed, which in operation is closed by a plug E^1 of alumina, clay, or other suitable refractory material. The carbon plates rest on the top of the fire-brick walls, which project above the top of the crucible; forming an intervening space F for insulating purposes, to prevent the short-circuiting of the furnace between B and E. For the vertical adjustment of the carbon pencil, a screw-threaded shaft G is provided, which may be propelled up and down by the engagement therewith of a suitably mounted rotative nut H.



Without entering into a detailed description of Mr. Willson's process, its main features may be broadly stated as decomposing, deoxidizing, or reducing refractory metallic ores or compounds by subjecting them, while intimately commingled, or mixed with an excess of finely-divided carbon, to the continued heat of an electrical arc. The mixed material being between separated electrodes, and the arc being quite close to that portion immediately under treatment, the formation of a bath of fused compound, and consequent ebullition and fluctuations in the resistance of the arc are prevented by the presence of the carbon.

As the actual result of their recent practice, the Willson Aluminium Company have found that they can produce one short ton of calcium carbide from a mixture of 1200 lbs. of fine coal dust and 2000 lbs. of burnt lime, and at an expenditure of about 180 electrical horse power per hour for twelve hours. These figures are not very far from those required by theory; and they agree very closely with those given by M. Moissan, who has also produced the carbide in an electrical furnace of his own invention. It would, therefore, seem safe to formulate the approximate cost of production somewhat as follows for both the carbide and the acetylene:—

1200 lbs. coal dust (say)	$2·50
2000 lbs. powdered burnt lime	4·00
180 electrical horse power from water, at (say) 50c. per hour for 12 hours	6·00
Labour, &c.	2·50
Cost per 2000 lbs. of calcium carbide (say)	$15·00
Cost per 2000 lbs. of acetylene (say)	$37·00

These figures would hold good, not only for the present works in North Carolina, but at any other place where very cheap water power and equally cheap coal, lime, and labour are procurable and accessible.

The specific gravity of the calcium carbide is 2·22 at a temperature of 18° C. (64·4° F.); and, as may be judged from its formula (C_2H_2), it is practically insoluble in all the ordinary reagents. Its qualities and characteristics have not been fully investigated; but M. Moissan has found that it may be heated in hydrogen gas, or exposed to nitrogen at 1200°, or to the contact of silicon or boron at a bright red heat, without undergoing any change, and that it is not affected by sodium and magnesium at the softening-point of glass, or by tin at a red heat. At a higher temperature than a dull red heat, it alloys with iron; and this is well worth noting, because it may be of interest in the future of the steel industry. It becomes incandescent in contact with chlorine, bromine, and iodine at the respective temperatures of 245°, 350°, and 305°; it burns in oxygen, with formation of calcium carbonate, at a dull red heat; and at 500°

* *Comptes Rendus*, [115] pp. 558-561.

† Proceedings of the Chemical Society (Eng.), Vol. CXVIII., pp. 15, 16.

it becomes incandescent in sulphur vapour, and yields calcium sulphide and carbon bisulphide. Water is decomposed by it very rapidly, and with evolution of pure acetylene; but its action upon steam is not so rapid, even when it is red hot, and the gas evolved is not pure acetylene, but contains free hydrogen. In dilute acids it behaves in the same way as with water; but it is only slightly attacked by fuming nitric and sulphuric acids, although ordinary sulphuric acid readily decomposes it—giving off an odour of aldehyde. Dry hydrogen chloride makes it incandescent, and the gas evolved contains a larger proportion of hydrogen. With fused chromic anhydride, it forms carbonic anhydride with incandescence; but with a solution of chromic acid, it produces acetylene only. It is oxidized by potassium chlorate or nitrate at a red heat, with incandescence and formation of calcium carbonate. Lead peroxide oxidizes it, with incandescence, below a red heat—the reduced lead containing calcium; and it becomes incandescent by trituration with lead chromate at the ordinary temperature.

This rapid summary of the results of preliminary investigations would seem to strengthen the opinion already expressed that calcium carbide chiefly claims our attention as a practically unlimited and most convenient source of pure acetylene; and there is little reason to doubt that its utilization in this direction will soon cause it to be manufactured extensively in America and other countries.

The hydrocarbon acetylene is regarded by chemists—and very justly so—as one of the most important intermediate bodies in the synthesis of organic compounds from their elements, and as one of the most interesting of the entire series. It is the only hydrocarbon that can be prepared directly from its free elements when the electric arc passes between carbon poles in an atmosphere of hydrogen; and it is worthy of consideration that this combination evolves heat to the amount of 61,000 units. This tremendous energy explains why the sudden decomposition of acetylene evolves enough heat to raise the temperature to 3000°, and why the intense molecular vibration produced by detonating a minute quantity of mercuric fulminate in 25 c.c. of it causes a violent explosion, accompanied with the production of free hydrogen and of finely-divided carbon. It has been hitherto produced for commercial purposes by the incomplete combustion of coal gas, according to the equation—

$$4CH_4 + 3O_2 = 6H_2O + 2C_2H_2;$$

and its purification has been effected by passing it through an ammoniacal solution of cuprous chloride, and subsequently decomposing the red precipitate with dilute hydrochloric acid. This is, of course, a very costly and tedious operation; and it is rendered a somewhat dangerous one by the highly explosive nature of copper acetylide. It is a colourless and very explosive gas, of most disagreeable smell, of specific gravity ·91. It burns with a very smoky, but much more luminous, flame than olefiant gas, and undergoes complete combustion when mixed with oxygen in the proportion of 1 : 2½ volumes. At a temperature of 1° C., and a pressure of 725 lbs., it becomes a mobile and highly refractory liquid, much lighter than water; whereas by heating it in a sealed tube, it is converted into a mixture of benzene (C_6H_6) and styrolene (C_8H_8). By passing sparks through a mixture of acetylene and nitrogen, hydrocyanic acid may be synthesized from its elementary constituents—

$$C_2H_2 + N_2 = 2HCN;$$

and from this there may, of course, be produced the whole of the cyanides and a large number of other important organic bodies. If the red precipitate of cuprous acetylide be treated with metallic zinc in a solution of ammonia, nascent hydrogen is produced, and ethylene or olefiant gas (C_2H_4) is formed. This in its turn can be combined with sulphuric acid in order to form sulphethylic acid—

$$C_2H_4 + H_2SO_4 = C_2H_5HSO_4;$$

and this, on being distilled with water, yields alcohol—

$$C_2H_5HSO_4 + H_2O = C_2H_6O + H_2SO_4.$$

The fascinating scope for intelligent and painstaking research thus opened up in so many and so varied directions, must strike all those who are in any way interested in inorganic chemistry as practically boundless; and the results will undoubtedly be revolutionary. For the purpose of giving better and cheaper illumination than the ordinary coal, water, and oil gases, acetylene is already occupying much attention; and it is from this direction that results will, in all probability, be first made apparent. The hydrocarbons of the ethylene and acetylene series give the illuminating value to gas made from the distillation of coal; while the illuminating value of water gas is derived from a mixture with the non-luminous gases of the same series of luminants obtained from the vaporization and cracking of petroleum oils. Since the power of the illuminants in any gas is in direct ratio to the relative proportion of its carbon and hydrogen, it must be plain that acetylene, on account of its great proportion of carbon, must be highly diluted to prevent it from burning with a smoky flame. When, however, it is diluted by mixture in proper proportion, either with water gas or with ordinary atmospheric air, its flame is smokeless, and of the utmost brilliancy and whiteness. The experiments that have been made by the Electric Gas Company have satisfactorily demonstrated that one short ton of calcium carbide will produce, by merely mixing it with water, about 10,500 cubic feet of acetylene, which, when combined with the required amount of air, produces a gas equal in illuminating value to 100,000 cubic feet of city gas of 22 to 25 candle power per 5 cubic feet standard burner. If to the estimated cost already given for the calcium carbide there be added (say) $15 per ton for freight, incidentals, and profit, the material for producing such a gas could be obtained at nearly all points for 30 c. per 1000 cubic feet, ready for burning; and the convenience with which the calcium carbide can be packed and freighted, combined with the easy preparation of the gas itself in great or small quantities at any time, should enable it, if not to be adopted for the ordinary supply of large cities, to provide for the requirements of country hotels, dwelling-houses, and railway cars.

The preceding article was reprinted in the *American Gaslight Journal* for the 24th ult.; and in reference to the subject thereof our contemporary made the following remarks: "For some months past the gas men of the country have been more or less concerned over the claims made by the promoters of a process for the manufacture of what they term 'pure acetylene' in solid form, that is, according to their story, about to revolutionize the manner and means at present employed for the enrichment of a 'lean' gas. But our readers who have long-term contracts with existing corporations for the supply of the normal solid or fluid enrichers need not be alarmed that such contracts have a goodly life; for the calcium carbide, or 'loaf sugar,' enricher is not to take the gas world by the ears just yet. Its promoters claim for it a yield of 10,000 to 12,000 cubic feet of 60 to 80 candle gas per ton (2000 lbs.) of the material, the cost of which to manufacture is put at $15 per short ton. We have good reasons for stating that, under the conditions existing in this vicinity, the cost to manufacture it will not be less than $22 per ton, which puts it out of court with fair-grade naphtha as an enricher, without making any note of the seeming instability of the gas produced."

Appended to the foregoing editorial pronouncement was the following note on the subject by President Morton, of the Stevens Institute of Technology, which appeared in the *Stevens Indicator* for October last: "Among the various uses to which electricity has been put, since its cheap production by the modern dynamo has been secured, is the reduction of metallic ores or compounds in one or another form of the electric furnace. The production of aluminium on a large commercial scale is the oldest and best known of these. There are, however, several cases in which the separation of the single element is not secured even in the electric furnace, but in which the element desired, while parting with its former companions, insists upon a substitute, and takes the same from the carbon electrodes or lining of the furnace, or from carbon mixed with it. This is the case in the manufacture of 'carborundum,' which is a compound of silicon and carbon, formed by heating silica and carbon powder in an electric furnace. This compound has reached a large commercial application, by reason of its extreme hardness, which makes it a very superior substitute for emery or corundum as a cutting and polishing material. The latest development in this direction, however, is seen in the calcium carbide, which is prepared by heating in an electric furnace a mixture of lime and coal dust. The metallic calcium liberated by the action goes at once into combination with carbon to form a carbide, which is a mineral body of very remarkable properties. In appearance, when in masses, it somewhat resembles the mineral serpentine; being of greenish-grey colour and crystalline fracture, with a lustre like felspar. If a few drops of water are thrown on this mass of seeming rock, gas is given off, which, if ignited, burns with a brilliant flame; and by continuing, from time to time, to sprinkle the rock with water, it will be made to blaze continuously, as though it were being sprinkled with some very volatile and inflammable oil. If a fragment of the mineral is thrown into a glass of water, a rapid evolution of gas results, which may be ignited, and will continue to burn until the mineral is exhausted. The cause of these actions is that the calcium carbide in contact with water forms calcium oxide and acetylene gas, the oxygen of the water combining with the calcium to form calcic oxide, or lime, and the hydrogen of the water combining with the carbon to form acetylene. It is proposed to use this calcium carbide for local gas machines. A charge of the mineral is placed in a closed vessel, into which a regulated supply of water is admitted. A little water entering forms a quantity of gas whose pressure shuts off the water; but, as the gas is used up, more water comes in to renew the supply. What may be the commercial value of this material we are not prepared to say; but it is certainly a great chemical curiosity."

The Engineering and Machinery Diary.—We have received from Messrs. C. Straker and Sons, Limited, a copy of a useful diary they have specially produced for those engaged in engineering and machine work. In addition to the matter generally to be found in diaries, Mr. Stephen Jeans has compiled a mass of formulæ, tables, directories, &c., extending over about forty foolscap folio pages, which come after the portion reserved for the entry of engagements day by day. He has thus brought literally under the hand of the user a great deal of information ready for reference during a consultation or whenever required.

THE REPORT OF THE "LANCET" COMMISSION ON INCANDESCENT GAS LIGHTING.

About a twelvemonth ago, we noticed at some length the important investigations carried out by the Analytical and Sanitary Commission of the *Lancet* in connection with the hygienic value of gas for cooking and heating purposes. The Commission have since turned their attention to its utilization, in conjunction with the Welsbach burner, for incandescent lighting; and the results of their experiments are set forth in a report which appeared in our contemporary on the 5th inst. To this we must refer our readers for full particulars of the work undertaken by the Commission; but the following extracts will make them acquainted with its scope and with the conclusions to which it led.

The report opens with a few remarks of a general character on the value of gas as an illuminant; and it is pointed out that, had it not been for Murdoch's genius and enterprise in 1792, and for the improvements since effected in its manufacture, even medicine would have been bereft, possibly to the present day, of many of its valuable agents. Coming to the methods of burning gas, the introduction and rapid adoption of the incandescent system is referred to, and the necessity enforced for an investigation into its merits, from the health point of view. An illustrated description of the Welsbach burner follows, and an explanation is given of its action. The burner is highly spoken of by the Commissioners; the opinion being expressed that it "affords an admirable illustration, and is probably the best result ever obtained, of the conversion of heat into light rays. . . . the production of radiant at the expense of calorific energy." In considering the burner from a hygienic standpoint, they say it may be regarded as "consisting simply of an ordinary Bunsen burner, over the flame of which is suspended a network of incombustible material that is intensely light-giving when raised to the temperature of the Bunsen flame." Attention is next given to that burner (which is really the Welsbach burner without its mantle); and it is explained that the conditions of combustion in an atmospheric burner are "more favourable, and the formation of complete products more certain, than in the luminous flame." Not only are the changes effected more complete by the introduction of air, but they occur at an earlier stage. Experiments with various burners, placed side by side, were carried out with the view of deciding this point at the outset of the inquiry; and the results (given in Table IV.) were decidedly in favour of the Bunsen burner.

Coming now to the subject of combustion products, the Commissioners say: "The complete combustion of a definite volume of coal gas must, on theoretical grounds, give rise to the production of exactly the same amount of burnt gases in whatsoever burner the gas is burned. Obviously, a cubic foot of gas burned completely in a batswing, Argand, or atmospheric burner, would give, as end-products, the same amount of carbonic acid and water. It follows, therefore, that if the consumption of gas be low, the evolution of products will be proportionately reduced; so that, apart from the economical point of view, a burner that consumes a relatively small amount of gas, to say nothing of the superior light it may yield, must be preferable on that account, from the hygienic point of view. This, therefore, is exactly what is secured in the Welsbach burner, by reason of the employment in it of an atmospheric burner which consumes at the most, but generally less than, 4 cubic feet of gas per hour. The indisputable hygienic advantages thus gained are strikingly illustrated in Table I., the results of which are based upon the varying rates of consumption of different burners. The amount of combustion products yielded by oil-lamps in the same time makes an interesting and instructive comparison."

TABLE I.—*Calculated Relative Quantities of Carbonic Acid Gas (CO_2) produced by Different Burners, based on One Cubic Foot of Coal Gas giving* 0·52 *Cubic Foot of* CO_2.

Burner.	Consumption in Cubic Feet.	Cubic Feet of CO_2 Evolved per Hour.	Number of Human Adults Producing same Amount of CO_2 per Hour.*
Welsbach (atmospheric burner)	3·5	1·82	3·03
Argand	6·0	3·12	5·20
Bray, No. 5 batswing . . .	6·0	3·12	5·20
Belge oil-lamp (16-candle power)	2·08 oz. oil per hour.	2·91	4·85
Hinks duplex (candle power undetermined) . . .	2·90 oz. oil per hour.	4·00	6·66

* Based on one human adult exhaling 0·60 cubic foot of CO_2 per hour.

The Commissioners point out that these results are purely speculative; and they proceed to describe some experiments they made with the view of putting them to practical test. These results are given in Table II. The experiments were made in a very small room, 10 feet long, 10 feet high, and 6 feet wide only; the usual crevices having first been closed. The amount of carbonic acid and the temperatures at two points—one just beneath the ceiling, and the other at breathing-level—were ascertained before the experiment, and repeated at intervals of an hour each after the burners had been lighted; the experiment being stopped after three hours. Two burners were fixed on the walls at a height of 6 feet, and were 9 feet apart in opposite corners—that is, at each end of the diagonal. "These conditions," the Commissioners say, "represent, of course, a very extreme and exaggerated case, owing to the size of the room and the use of two burners in it; but the trials were strictly comparative, and the errors introduced in the analyses and observations were reduced in proportion as the products were greater and the rise of temperature higher. In the last experiment, an oil-lamp was placed upon a table 3 feet high, as this was considered to represent the actual conditions of practice. The lamp was carefully weighed before and after the experiment; the difference in weight giving, of course, the amount of oil (kerosene) consumed." The results are, they point out, of great interest and importance in regard to the health aspect of the case.

Referring to Table II., the Commissioners say: "The chief points calling for notice are as follows: The relative effects of a Welsbach burner with and without a mantle are especially instructive, as affording some information of distinct value as to the chief differences caused by the introduction of a mantle into the flame. The sum total products should, of course, be the same, since the amount of gas consumed was the same. The mean amount of carbonic acid, as a matter of fact, was, as the table shows, as nearly as possible identical. But by the introduction of the mantle into the flame, it is evident that there occurs a concentration of the carbonic acid close to the ceiling; while there is, as we should expect, a corresponding and very decided diminution at the breathing-level. We conclude, therefore, that the plain Bunsen flame (enclosed in a chimney) produces a quicker and more decided distribution of the burnt gases or products in the room, owing, no doubt, to the greater freedom of space around the flame, and the consequently increased draught up the glass chimney. On this explanation, the introduction of the mantle into the flame would naturally reduce the rate of draught through the chimney. The same is true of the temperature, which after the first hour was raised by the Welsbach burner with its mantle only 6° at breathing-level; but in the case of the burner without the mantle, it was raised 10°. Indeed, the increase of temperature, as might be expected, appears *pari passu* with the carbonic acid. So far, then, the Welsbach burner is distinctly more satisfactory in its effects upon the air of a room at breathing-level than even the plain atmospheric burner. When we look at the effects of the Argand and batswing burners, of course the carbonic acid and temperature increase enormously, in accordance with the greater consumption of gas. The Argand vitiates the breathing-level somewhat sooner than the batswing, in consequence, no doubt, of the impetus given to circulation by the use of a chimney. This is true also of the increase in temperature. Finally, the oil-lamp effects a gradual and general distribution of both the heat and carbonic acid produced; the amount of these being the same both at the ceiling and breathing-level. It should be observed in addition, however, that though with the oil-lamp, as might be anticipated, the rise of temperature is not so great as two Welsbach lamps (the proportion of hydrogen in oil, the chief heat-producing constituent of coal gas, being relatively small), yet the mean amount of carbonic acid produced was almost exactly the same after three hours. So that the vitiation of air with carbonic acid gas by one Welsbach burner giving over 50-candle power light, and consuming 3½ cubic feet of gas, is less than one-half that produced by an oil-lamp of 16-candle power, and consuming a little over 2 oz. of oil. We have here a striking fulfilment of the requirements of theory in Table I., and therefore some distinct evidence of the accuracy of the experiments."

The Commissioners next turn to Table III., in which are shown the relative vitiating and heating effects of several types of burners. In reference thereto, they say that one can "see at a glance the merits of the Welsbach burner, contrasted with various other burners, from the point of view—*i.e.*, the hygienic—which prompted the present inquiry." They offer some explanatory remarks on the figures presented; and they conclude this part of their report by saying they find in them further reason for believing that the general results are satisfactory.

In the experiments already described, the Commissioners purposely omitted to search for unburnt gases, such as carbon monoxide or acetylene, which, if found, even in small traces, would afford emphatic ground for objection to the general adoption of a burner from which these poisonous products are shown to escape. They preferred to exaggerate the ordinary conditions under which a burner is used still more than before, so as to focus any possible impurities of this sort, and in order to be quite sure that even the smallest traces would not escape their tests. The experimental procedure of this section of the inquiry was as follows: "The burners (in the case of the Welsbach, two in number, but of the rest only one) were lighted and placed in a small chamber 3 ft. 1 in. by 3 ft. 1 in. by 2 ft. 4 in. (with no provision for any appreciable ventilation or outlet for the gases) for eight hours. During the whole of this time the air taken from above the burners was aspirated first over potash and soda-lime, to remove carbonic acid and sulphur compounds; then through sulphuric acid, to remove ammonia; and,

TABLE II.—*Vitiating and Heating Effect of Various Burners in a Room 10 Feet Long, 10 Feet High, and 6 Feet Wide.*

Burner (6 Feet from Floor).	Carbonic Acid (CO_2) contained in 10,000 Volumes of Air.				Temperature in Degrees Fahrenheit.				Consumption of Gas in Cubic Feet per Hour.
	Original Air.	After One Hour.	After Two Hours.	After Three Hours.	Original Air.	After One Hour.	After Two Hours.	After Three Hours.	
Two Welsbach—									
(*a*) At 1 foot below ceiling	6·0	67·2	77·9	80·5	53·0	68·0	76·0	81·0	7
(*b*) At breathing-level	6·0	10·5	17·0	18·2	53·0	59·0	63·0	65·0	
(*c*) Mean result	6·0	38·8	47·4	49·3	53·0	63·5	69·5	73·0	
Two Welsbach without mantles—									
(*a*) At 1 foot below ceiling	6·0	54·9	56·5	63·1	53·0	75·0	78·0	80·0	7
(*b*) At breathing-level	6·0	23·2	36·8	32·9	53·0	63·0	64·0	65·0	
(*c*) Mean result	6·0	39·5	46·6	48·0	53·0	69·0	71·0	72·5	
Two Argand—									
(*a*) At 1 foot below ceiling	6·0	93·1	117·6	119·0	53·0	79·0	84·0	89·0	12
(*b*) At breathing-level	6·0	38·6	48·6	50·2	53·0	65·0	68·0	72·0	
(*c*) Mean result	6·0	65·8	83·1	84·6	53·0	72·0	76·0	80·5	
Two Batswing, Bray, No. 5—									
(*a*) At 1 foot below ceiling	6·0	84·1	108·2	115·7	53·0	78·0	89·0	95·0	12
(*b*) At breathing-level	6·0	37·6	46·6	47·4	53·0	59·0	65·0	69·0	
(*c*) Mean result	6·0	60·8	77·4	81·5	53·0	68·5	77·0	82·0	
One Belge oil-lamp, 16-candle power (on table 3 feet a bove fl o—									Consumption of Oil.
(*a*) At 1 oot belw ceiling	6·0	38·7	48·:	53·6	53·0	62·0	65·0	66·0	2·08 oz. per hour.
(*b*) At breathing-level	6·0	23·7	35·3	44·5	53·0	59·0	61·0	63·0	
(*c*) Mean result	6·0	31·2	41·7	49·0	53·0	60·5	63·0	64·5	

TABLE III.—*Increase of Carbonic Acid and of Temperature per Candle Power.*

Burner.	Consumption.	Illuminating Power.	Mean Increase of Temperature in One Hour.	Increase of Temperature per Candle Power.	Mean Increase of CO_2 in One Hour.	Increase of CO_2 per Candle Power.	Increase of CO_2 per Cubic Foot of Gas Consumed.	Increase of Temperature per Cubic Foot of Gas Consumed.
	Cubic Feet.	Candles.	Degrees.	Degrees.	Parts per 10,000.			Degrees.
Two Welsbach	7	50 + 40	63·5−53=10·5	$\frac{10·5}{90·0}$ = 0·116	32·80	$\frac{32·80}{90}$ = 0·365	4·80	1·5
Two Argand	12	16 + 16	72 0−53=19·0	$\frac{19}{32}$ = 0·590	60·00	$\frac{60·00}{32}$ = 1·900	5·00	1·5
Two batswing (Bray, No. 5)	12	9·6 + 9·6	68·5−53=15·5	$\frac{15·5}{19·2}$ = 0·807	55·00	$\frac{55·00}{19·2}$ = 2·860	4·60	1·3
One Belge oil-lamp	2·08 oz. oil per hour.	16	60·5−53= 7·5	$\frac{7·5}{16}$ = 0·468	25·20	$\frac{25·20}{16}$ = 1·560	—	—

finally, through a dilute solution of blood. At the end of eight hours, the experiment was stopped, and the blood examined with a delicate spectroscope. To preclude any doubt whatever as to the presence of carbon monoxide, the blood was further treated in the following manner: Fresh air was caused first to pass through a solution of palladium chloride, to remove organic or other chance impurities; then through the blood, the temperature of which was gradually raised by means of a water-bath; and, finally, through a third tube containing chloride of palladium. Any carbon monoxide absorbed by the blood during the aspiration of the combustion gases would thus be displaced; and would cause a darkening in the palladium solution due to separation of the metal." Acetylene was also searched for; the solution of ammoniated silver nitrate being employed for the purpose. The results obtained are given in Table IV. It will be seen therefrom that, except in the case of the batswing burner, no distinct evidence of undesirable products in the burnt gases was found. The Commissioners add that "even when the gases were aspirated for hours straight from the chimney of the Welsbach burners, neither of the poisonous gases carbon monoxide or acetylene could be detected." The Argand burner was equally satisfactory.

TABLE IV.—*The Results of Tests with Various Burners for Carbon Monoxide (CO) and Acetylene (C_2H_2) in the Products of Combustion.*

Burner.	Blood Test (Carbon Monoxide).	Palladium Chloride for Carbon Monoxide in Previous Blood.	Ammonia Silver Nitrate Test for Acetylene.
Two Welsbach burners without mantles=atmospheric burner, consumption 7 cubic feet per hour	Negative.	Negative.	Negative.
Two Welsbach burners (complete), consumption 7 cubic feet per hour	Negative.	Negative.	Negative.
One Argand burner, consumption 6 cubic feet per hour	Negative.	Negative.	Negative.
One Bray batswing, consumption 6 cubic feet per hour	Slight indication.	Slight indication.	Doubtful.

In the next section of the report, the Commissioners deal with the relative illuminating power of various burners, and the loss of light sustained by the use of tinted and other chimneys with the Welsbach burner. They point out that the light produced by this burner is intensely white and brilliant; and for some purposes it is desirable to reduce its intensity, so as to make it affect to a less degree the muscles of accommodation of the eye. Comparing four kinds of chimneys which may be employed for this purpose—mica, amber glass, ruby, and red—the Commissioners remark that "the ruby chimney gives a light of 27 candles, which, in appearance, approaches the Argand gas-flame very closely; while the mica chimney, though absorbing a small amount of light, is unbreakable." From the tabulated results given in this section of the report, we take the following figures: A new Welsbach burner, with glass chimney, consuming 3 cubic feet of gas per hour, had an illuminating power of 60 candles; with mica chimney, and consuming 3·5 cubic feet per hour, 56 candles (a second trial, with 3 cubic feet consumption, giving 50 candles); with amber glass chimney, and a consumption of 4 cubic feet per hour, 52 candles; with ruby chimney and same consumption, 27 candles (30 candles with 3 cubic feet); and with red chimney and 3 cubic feet consumption, 50 candles. The loss of efficiency per cubic foot of gas in each case was as follows: Mica chimney, 1·01 and 3·33; amber glass chimney, 2; ruby chimney, 8·25 and 10; red chimney, 3·33.

In their concluding remarks, the Commissioners say: "In considering the systems of artificial lighting that are in vogue at the present time, the incandescent system of electric lighting must, of course, rank first from the point of view of health, since it affords a soft, agreeable light, without giving rise to any vitiation of the air. There is no combustion, and consequently there are no products of combustion, complete or incomplete. From the same point of view, we are bound to place next, in the face of the result of our present inquiry, the incandescent gas-light in its improved form. It is even less productive of carbonic acid gas than the average oil-lamp, and consumes not quite one-half less gas than the existing type of burners—giving rise, therefore, to the evolution of half the heat and half the amount of carbonic acid gas; while its illuminating power, expressed in candles, is more than three times as great as the best ordinary gas-burners or the incandescent electric lamp, each of which does not generally exceed 16-candle power, unless very great expense is no object to the consumer. We are far from saying that the incandescent system of gas lighting has attained to the highest pitch of perfection. Still we are well within bounds when we regard it as the system of gas lighting which utilizes most efficiently and most economically the full power or duty of coal gas as an illuminating agent. Some have expressed fears that the burner is a delicate instrument—much too delicate—for the part it is destined to fulfil. But we found with ordinary care—and care is well worth a little exercise in view of the enormous advantages the system affords—that these fears need not exist. . . . The production of a cheaper gas since the introduction of the incandescent system of lighting

has, we believe, engaged the serious attention of engineers, chemists, and others; and we may expect to hear more on this important question before very long. To hygienists this is an extremely important aspect of the incandescent gas system, inasmuch as it is obvious that the introduction of cheaper gas, by its more extensive employment for fuel, would tend to free London from the reproach of being a city which, during the greater part of the winter, is enveloped in vilely suffocating fogs. There is, therefore, we think, a future for the new system of far-reaching importance to the community."

MR. R. FORBES CARPENTER ON THE ENRI HMENT OF GAS.

The present session of the Manchester Section of the Society of Chemical Industry was opened with an exceedingly interesting address by the Chairman, Mr. R. FORBES CARPENTER, F.I.C., one of the District Inspectors under the Alkali Act. The full text has appeared in the *Journal* of the Society; but we have received from the author a reprint of it in pamphlet form.

The first portion of the address was devoted to a consideration of matters coming within the scope of Mr. Carpenter's professional work; his remarks being to a large extent directed to a book lately published by Dr. J. T. Arlidge, "On the Hygiene, Diseases, and Mortality of Occupations." He also dealt at some length with the lecture delivered by Professor Kennedy at the Royal Institution in April, 1893, on "Possible and Impossible Economies in the Utilization of Energy," which has been already noticed in our columns. The next matter discussed was the utilization of town refuse in the generation of electric energy; and then the author passed on to the subject of the electrolytic process for the production of caustic goods and chlorine. In the closing portion of his address, Mr. Carpenter reviewed the work which has lately been done in connection with the question of the enrichment of coal gas. After expressing regret that chemical subjects connected with the gas industry are discussed in papers submitted to the various District Associations of Gas Managers rather than in communications presented to the Society, and saying he hoped the session would not pass without one or more of such papers being received (the chemical side of gas manufacture never having reached a more interesting stage of development than it has now attained) Mr. Carpenter proceeded as follows:—

Two movements opposite in principle are now dividing the gas world. Let me try and shortly summarize the position. In view of the tendency of parliamentary demands for increase of candle power, and of the limitation of supplies of cannel, coupled with the cheap price of petroleum oils, several processes which you will find described in our *Journal* have come more or less into vogue for increasing the illuminating power of gas; among others I might name the Peebles process and the Tatham, or oxy-oil, process. In others, carburetted water gas, as in the Lowe process, is adopted as an adjunct. I learn, on the authority of Professor Vivian B. Lewes, that last winter (1893-4) 10 per cent. of the gas supplied by The Gaslight and Coke Company was derived from this latter source; and the ordinary gas of 14 or 15 candles was enriched with the 22-candle water gas, and sent out at 17 or 17·5 candles, to ensure getting the required 16 candles at the testing-stations. That gas engineers should be alive to the advantage of having an appliance that can be so rapidly put into operation as the one I mention, is not to be wondered at when we remember the demands upon their plant that are sure to arise on the advent of fog lasting perhaps a week. It is impossible to heat up beds of retorts quickly enough for the requirements. The sanitary drawback, however, will at once suggest itself to you. It is not desirable to increase the percentage of carbonic oxide in our burning gas, as the increase of danger of accidents by escape and use rises in direct proportion. I will do no more than mention this feature that should not be lost sight of.

But there is another feature of greater interest to us as chemists. In proportion as the percentages of carbonic oxide and hydrogen are increased, in such degree does the height of the flame of the gas lessen when burned; and to this cause more than any other does Professor Lewes attribute the complaints by consumers of defect of illuminating efficiency that have arisen. The following are some figures obtained by him in burning 5 cubic feet of different gases per hour in a standard Argand:—

Gas	Height of Flame in Inches.
Hydrogen	0·985
Carbon monoxide	2·206
Carburetted water gas	2·500
Methane	4·250

This statement prepares us now to appreciate the argument of the other school of gas engineers that contains the eminent names of Mr. George Livesey and Mr. Thomas Newbigging, and receives the weighty support of Professor Lewes. Mr. Newbigging is perhaps the most recent exponent of the view that the enrichment processes are all tendencies in the wrong direction. He distinguishes between illuminating power and illuminating effect. The former, of course is the photometric measurement and comparison of the light with that of standard candles, in which process the eye of the observer is carefully shielded from all direct sight of the flames. A light of high illuminating power may not have by any means so great a proportionate illuminating effect (take the arc light as an instance of this familiar to everyone). As one passes from the South of England to Scotland, the illuminating power of gas rises from 16 candles in London to 18 to 19 candles in Manchester and Salford, and to 22 and 24 candles in Edinburgh. Will anyone, says Mr. Newbigging, contend that it is possible to obtain proportionate increase of illuminating effect. The natural illuminating power, without enrichment, given by the Durham coals in use in London is about 14·5 candles; and Professor Lewes found hardly any difference in candle-units per foot of gas consumed in No. 4 and No. 5 flat-flame burners (which form 85 per cent. of those in domestic use) between 14·5 and 16 candle gas—the absolute figures of candle-unit efficiency being: No. 4, 1·74; and No. 5, 1·87. When I tell you that the maximum candle-unit efficiency per cubic foot of gas, when used in regenerative burners, is 10, you will see that there is plenty of room to improve up to the best in the department of burners, and that it is quite arguable that the great cost of enrichment is so much money wasted. As an experiment, the South Metropolitan Gas Company sent out for the period of a fortnight unenriched gas of about 14·5 candles without receiving complaint from a single consumer.

The point I have previously mentioned as to the size of flame has a distinct bearing on this question of illuminating effect. A natural coal gas, containing its due proportion of methane, will give a larger flame than an enriched one; and the illuminating effect of the larger flame will be as great as that of a smaller and more intensely brilliant surface of flame obtained from an enriched gas of higher candle power. In addition, there are physiological reasons supporting the contention of this school; the eye automatically and involuntarily closing against admitting too many rays from a highly brilliant flame.

It will be most interesting to watch the progress of the newer ideas. If, in Manchester, some of the money spent in enrichment were only diverted to purification from sulphur impurities, we should (with all due respect to Professor Lewes, who is still unconvinced by the arguments this Section has brought forward) be deeply grateful to the authorities. Those of you who feel interested enough in the subject to make further acquaintance with it will do well to read the paper by Mr. Newbigging at the last meeting of The Gas Institute, and the discussion thereon, to be found *in extenso* in the JOURNAL OF GAS LIGHTING.*

One drawback to enrichment processes I have not named—the fact that the gas is the carrier of hydrocarbon vapours. This leads to stratification in the gasholders; and when the gas passes along the mains with the friction against the skin of the pipe, tendency to condensation and deposit of liquid hydrocarbons arises; so that, to reach the consumer, gas of a proportionately higher candle power must be sent out from the works. We had some years ago, in Salford gas, during the period when the Hawkins process was in use, sufficient evidence of this phenomenon.

DR. LUNGE ON THE ASSAY OF "REFINED" TAR.

[This paper was communicated in the first instance to the *Zeitschrift für Angewandte Chemie*, and reproduced recently in the *Journal für Gasbeleuchtung;* and the subject was briefly alluded to in the JOURNAL for Dec. 11 last (p. 1115). The references to the author's "Coal Tar and Ammonia" in the following abstract translation of the paper are made to the second English edition, in place of the corresponding references in the original to the third German edition.]

The name of "prepared" or "refined" tar is applied to commercial products made by the admixture of coal-tar pitch with tar distillates in varying proportions (*cf.* "Coal Tar and Ammonia," p. 278). The hard pitch which remains after all volatile bodies have been distilled off from coal tar is with difficulty removed from the still, and has but a limited use. If, however, a quantity of the less valuable oils (*e.g.*, green oil) from the distillation is pumped on to the pitch while still in a molten state in the still, products of marketable value are formed, varying according to the nature and proportion of the oil added. Among these products are soft pitch, medium-hard pitch, artificial asphalte, varnish of various consistencies for ironwork, and refined tar. Originally the last term was reserved for a mixture of similar consistency to crude tar, and applicable to the same purposes. It was superior to crude tar, owing to its freedom from very volatile constituents, which caused cracks in a coating of the latter as it dried, and gave it its characteristic odour. It is evident the use of "refined" in place of crude tar has many advantages to the manufacturer, and gives the user a large choice in the consistency of the material.

As very varying compositions are sold under the designation "refined tar," it has become desirable to draw up certain rules to be adhered to in the examination of it, in order that disputes between buyer and seller may be avoided. A recent case in which the author was called upon to give expert evidence showed that there is at present no consensus of opinion as to

* See Vol. LXIII., p. 1219; and Vol. LXIV., p. 14.

the testing; and he propounds the following as a suitable standard method applicable in all ordinary cases. Three samples of tars of German and Polish origin, obtained through the German Continental Gas Company, served for the investigations undertaken in the elaboration of the analytical method. It is desirable that the examination should in most cases afford an indication of the suitability of the tar for the purpose to which it is to be applied; and the method must also be simple and rapid, and easy of repetition with similar results by another experimentalist. The first requirement can be but imperfectly met, as many of the properties of refined tar cannot be observed under the limitations of laboratory testing. It is, however, quite possible to gain assurance of the uniformity of different supplies, and their conformity with a given standard.

Three properties form the basis of the examination. It comprises the determinations of specific gravity, viscosity, and the proportion of volatile matter. Some modification of existing methods of determination is necessary in most cases; and the following hints are given: For the determination of *specific gravity* with accuracy in the case of very viscous tar, the hydrometer is useless. An ordinary specific gravity bottle does not answer well; and it should be replaced for this purpose by one of the ordinary stoppered weighing-tubes used in gravimetric analysis—a small notch having been filed in the side of the stopper. The flask is filled with the tar, the stopper inserted, and the tar overflowing through the notch carefully removed with blotting-paper. The flask and its contents are then to be weighed. The tar may easily be completely removed from the tube by means of blotting-paper and a little oil. There is, however, a source of error from the inclusion of air bubbles, which can only be removed by warming the tar. On cooling, the tar contracts; and the bottle must be filled up again, with the inclusion of fresh air bubbles. It is also difficult to completely remove tar from the small trough between the rim of the tube and the stopper. These difficulties can be obviated by partially filling the tube with tar, and then completely filling it with water. Let a equal the weight of the tube; b, its weight filled with water at 15° C. (59° F.); c, its weight when filled to about two-thirds its height with the tar, from which air has been removed by warming before the weighing is made; and d, the weight of the tube when the space above the tar is filled with water—the tar and water being brought to a uniform and known temperature by immersing the tube for some time in a large vessel of water. The specific gravity of the tar is—

$$\frac{c-a}{b+c-(a+d)}$$

With the three samples examined, which may be distinguished as A, B, and C, the specific gravities found by this method were: A = 1·1649 at 18° C. (64·4° F.); B = 1·1972 at 23° C. (73·4° F.); C = 1·2424 at 20° C (68° F.).

The *viscosity* cannot generally be ascertained by the ordinary forms of viscosimeter in use for oils. The rate at which an instrument similar to a hydrometer sinks up to a certain point into the tar affords a somewhat rough, but readily executed, test. This instrument, which may be called the "tar-tester," differs from ordinary hydrometers in having a simple cylindrical body with a plain hemispherical lower end, and is also of somewhat stouter glass. The body is 20 mm. (0·8 inch) in diameter, and 100 mm. (nearly 4 inches) in length. The stem is 8 mm. (0·3 inch) in diameter, and 225 mm. (8·9 inches) in length. The mark which corresponds to the specific gravity 1·4 is 15 mm. (0·6 inch) above the shoulder of the instrument; and the scale extends upwards 190 mm. (7·5 inches), terminating at the mark corresponding to a specific gravity 1·050. The most important point on the scale is the mark 1·250, which is about 82 mm. (3·2 inches) from the shoulder. The weight of the instrument is about 600 grains. The tar to be tested is poured into a cylindrical vessel until it is nearly filled; it is well agitated, and its temperature taken. If this is other than 15° C. (59° F.), the cylinder is stood in a large vessel of water until the tar reaches this temperature. The tar-tester is then immersed up to the point 1·250, withdrawn, allowed to drain for three minutes, and then held with its lower end touching the surface of the tar until the seconds hand of a clock passes the zero point, when the tar-tester is released, and allowed to sink in the tar. The time at which it has sunk up to the mark 1·250 is observed; and the time the instrument has taken to sink up to this point is a measure of the viscosity of the tar. The mark 1·250 is sufficiently below that of the specific gravity of the tar to allow the sinking to proceed up to the last at a reasonable rate. Three or four observations should be made with every sample; the tar-tester being merely allowed to drain for two or three minutes before re-immersion. Small differences in the weight of tar-testers do not affect the accuracy of the results; so there is no difficulty in the production of instruments such as those used by the author. The mean result with tar A, at 15° C. (59° F.), was 35¼ seconds; at 24·5° C. (76° F.), 10⅜ seconds. Tar B, at 15° C. (59° F.), had a viscosity equal to 70 seconds, and at 23·5° C (74·3° F.), 32⅜ seconds. Tar C was scarcely fluid at ordinary temperatures; and at 23·5° C. (74·3° F.), the tester took several hours to sink to the point 1·250

The *amount of volatile matter* is found most simply by distilling 100 grammes of the tar in a tubulated retort, and collecting the distillate in a graduated cylinder. The specific gravity of the distillate is afterwards taken, and the specific gravity and temperature of softening of the pitch found (*vide* "Coal Tar and Ammonia," p. 294). If a moderately hard pitch has not been obtained, the experiment should be repeated; a greater or smaller quantity of oil being distilled off according to the result of the first test. The second, or at most a third, experiment will give the desired moderately hard pitch. From the mean of two tests, tar A was found to yield 43·5 per cent. by weight of oil, and 56·5 per cent. of moderately hard pitch. Tar B gave 36·5 per cent. by weight of oil, and 63·5 per cent. of the required pitch. Tar C gave 23 per cent. by weight of oil, and 77 per cent. of the moderately hard pitch.

From the above it may be judged that the desired properties of a refined tar may be sufficiently stated in terms of the tests above described. Thus a maximum and minimum permissible specific gravity, viscosity, and percentage of volatile matter should be prescribed, though in general the specific gravity and the viscosity alone will suffice to determine the character of a tar. These tests afford a ready and useful means of examining samples of refined tar.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

Gas Traction for Tramways.

SIR,—I think Mr. Denny Lane may be slightly in error in his deduction of the cost of traction on gas tramways from the rather scanty statements of Herr W. von Oechelhaeuser as to the working cost of the gas tramway at Dessau. The out-and-home journey referred to is probably over one section only, as each section is worked by its own allowance (three on week days) of cars. Therefore the mileage traversed for each full charge of gas would be 6·2 miles in the case of one section, and 4·8 miles in the case of the other section, instead of the 11 miles given by Mr. Denny Lane. I am unacquainted with the topography of Dessau; but it appears that the two sections are not continuous to one another in the same, or nearly the same, direction, but either cross at a short distance from one end of each, or bifurcate from a short common trunk line. There appears to be no other explanation of the fact that the total length of line is 2¾ miles, but that passengers changing from one section to the other travel only 2¼ miles. (In the original, these distances are 4·4 and 4 kilometres respectively.) The correction of Mr. Denny Lane's figures in accordance with the more probable reading of Herr von Oechelhaeuser's statements in no sense invalidates the general tenor of his argument in favour of mechanical street traction.

Some interesting computations of the cost of gas and other systems of traction for tramways were given in the JOURNAL for Jan. 23, 1894 (p. 153).

Jan. 9, 1895. THE TRANSLATOR OF THE ARTICLE "THE GAS TRAMWAY AT DESSAU."

Gas-Fires for Hotel Bedrooms.

SIR,—Some time ago, considerable correspondence took place in the JOURNAL in connection with the above subject; but I do not think the simple and comparatively inexpensive arrangement used in Paris was mentioned. There a clock and main-tap, called a "*compteur horaire*," combined in a small box 5 in. by 2½ in. by 2 in., meets the case admirably. The working of the *compteur* is simplicity itself, because the occupant of the bedroom has only to turn a tap and light the fire in the usual way. When the tap is turned on, the clock, which has a 24-hour dial, starts, and indicates the time the fire is in use. When the fire is no longer wanted, the tap is closed, and the clock stops. The box containing the clock and tap can be fixed at any convenient spot, and in view of the traveller. The clock is locked up; but the dial can be seen, and the tap is free to be used at all times. All that the hotel proprietor requires to know is the average hourly consumption of the gas-fire, and to note the time of the clock when the room is taken and vacated; the amount of gas used, if any, being charged for in the bill. Such an arrangement as this is, I think, decidedly preferable to any kind of meter.

Birkenhead, Jan. 10, 1895. T. O. PATERSON.

The Cost of Incandescent Gas-Light Fittings.—As a considerable amount of misunderstanding exists, among those interested in the gas industry generally, as to the cost of the incandescent gas-burner, we have been asked by the Secretary of the Incandescent Gas-Light Company, Limited (Mr. L. de Fonblanque), to publish the following explanation: "We find that, as a result of our selling mantles for renewals at the reduced price of 1s. 3d., some customers think that, in selling the entire lamp, with mantle, at our present list prices, we are charging an extravagant price for the burners and other adjuncts. In a recent case that has come to our knowledge, a grievance seems to have been felt because we would not supply mantles unconditionally at the reduced price, which mantles might be adapted to some cheap Bunsen burner not of our own manufacture. We feel sure it only wants an explanation to the public to show them the injustice of such an attitude as this. Our experience has taught us that the taking up of the light by the public was much hindered by the cost of the renewal of the mantles. It was desirable, therefore, to get this item down as low as possible; and the price we are now charging may be considered as based on the manufacturing cost alone, and providing nothing in the nature of patent royalty. The price we charge for each new burner with mantle may be treated, therefore, as covering a licence for the use of our patents in relation to mantles as long as the particular burner lasts; and if several shillings of the price are attributed to this, it gives a royalty of only a few pence each when spread over the mantles that will be used with that burner during its existence. The remaining amount of the first cost of each installation leaves only an ordinary commercial price for the burner and adjuncts."

PARLIAMENTARY INTELLIGENCE.

PROGRESS OF GAS AND WATER BILLS.

Opposition to the London Water Bills on Standing Orders.

The time allowed for the deposit of memorials complaining of non-compliance with Standing Orders in the case of the petitions for the first hundred Bills in the general list, expired last Wednesday, by which day memorials had been presented in regard to the following Bills: Barnsley Corporation Water Bill, from the Corporation of Rotherham; Chelsea Water-Works (Transfer) Bill, from the Governor and Company of the Chelsea Water-Works and from debenture stockholders; Dewsbury and Heckmondwike Water Bill, from the Corporations of Bradford and Rotherham; East London Water-Works (Transfer) Bill, from the East London Water-Works Company and debenture stockholders; Grand Junction Water-Works (Transfer) Bill, from the Grand Junction Water-Works Company and debenture stockholders; Kent Water-Works (Transfer) Bill, from the Company of Proprietors of the Kent Water-Works and debenture stockholders; New River Water-Works (Transfer) Bill, from the New River Company and debenture stockholders; Rotherham Corporation Bill, from Henry Horsfield.

The petitions for the remaining Bills among the first hundred in which our readers are interested will consequently go forward unopposed. These are: Ambleside Local Board (Gas and Water) Bill, Aberdeen Harbour Bill, Bray, &c., Water Bill, Bristol Water Bill, British Gaslight Company Bill, Chelsea Water Bill, Chesterfield Gas and Water Board Bill, Clonmel Corporation Bill, Cranbrook District Water Bill, Croydon Corporation Bill, Dublin Corporation Bill, Edinburgh and District Water Bill, Felixstowe and Walton Water Bill, Hayward's Heath Gas Bill, Ilfracombe Gas Bill, Kingston-upon-Hull Corporation Bill, Lambeth Water Bill, Merthyr Tydfil Local Board Water Bill, Newmarket Gas Bill, North Middlesex Gas Bill, Scarborough Gas Bill, South Metropolitan Gas Bill, Whitby Water Bill, York New Water-Works Bill.

The Examiners will commence their duties on the 18th inst.; and the memorials presented by the London Water Companies will be among the first to be considered.

A Gasholder Overturned at Rothwell.—Last Tuesday night a small gasholder belonging to the Rothwell Gas Company was overturned, causing a loss of 400,000 cubic feet of gas. It is believed the accident was due to decay of the pillars and foundations.

The Alleged Defalcations from The Gaslight and Coke Company.—In reference to a paragraph on this subject appearing in last week's JOURNAL, we are informed that the defalcations charged against Charles Ross, late a Collector in the Company's service, do not total to more than £350; and that the Company, under their system of guarantee, will not lose a single penny of the amount.

The Middlesbrough Gas Committee and Water Gas.—At last Tuesday's meeting of the Middlesbrough Town Council, Alderman Hugh Bell, in moving the adoption of the minutes of the Gas Committee, which authorized the Gas Engineer (Mr. David Terrace) to report as to the advantages of water gas, said the Committee had not at all committed themselves to the use of that gas. It was employed in some other towns, and would be useful in Middlesbrough if its advantages were not overridden by disadvantages, of which those acquainted with the subject were quite aware. They fully saw that, before they determined upon anything, they ought to have full information on the subject. When they had obtained this information, it would be laid before the Council. His own feeling was against water gas; but he approached the question with a neutral mind, although tending a little against it.

Ripon Corporation Gas Affairs.—The Mayor of Ripon (Mr. Baynes) made a statement to his colleagues on the Council, at their meeting yesterday week, respecting the quality and quantity of the gas supplied in the city, about which there had been complaints. The tests at the works showed that the average illuminating power last year was 16¼ candles; and in December, 17⅛ candles. The Gas Committee had recently erected two additional settings of six retorts; thus adding one-third to their producing power. They had not, however, found it necessary as yet to use the new retorts. The pressure had also been raised from 22-10ths to 29-10ths. It was proposed to increase the size of the mains in certain streets, at a cost of £370; but the Manager stated that in four out of five cases of want of pressure, the fault was in the service-pipes. Extensions and alterations at the works last year cost £460. In five years the whole debt on the capital account (originally £18,000) would be paid off; and this would relieve the revenue account of a charge of £790 per annum. Then, in his opinion, would be the time to go in for the electric light, unless there was such an improvement in the production of gas as to enable it to compete with that light.

Bilston Gas Company.—The annual meeting of this Company was held yesterday week. In moving the adoption of the Directors' report (which was noticed in the JOURNAL for the 18th ult.), Mr. T. Holcroft, who presided, referred to the increased assessment of the Company's property. About ten years ago, he said, a firm of valuers assessed the works in Coseley; but last year the same firm reassessed them, and doubled the assessment, notwithstanding the fact that the capital had been raised very little indeed, and that the profits and dividends had not advanced during the interval. They appealed against the reassessment, and obtained a reduction; but the law costs amounted to £1105, and of this above £700 had to be paid by the Company. Alluding to other questions, he said the coal strike was a difficulty with which the Directors had had to contend, as they had to provide for an exceptional outlay of between £800 and £900. The decrease in the consumption of gas noted in the report was mainly due to bad trade in the district, and the decline of large businesses. The Directors had for many years been working for a reduction in the price of gas; but in the face of increased rates and taxes, he did not see how their aims could be satisfied. The report was adopted.

MISCELLANEOUS NEWS.

THE FALKIRK GAS-WORKS ARBITRATION.

(*Before Mr.* CORBET WOODALL, M.Inst.C.E., *and Mr.* E. H. STEVENSON, M.Inst.C.E., *Arbitrators.*)

Thursday, December 20, 1894.

(*Continued from p.* 84.)

Mr. *G. E. Stevenson*, M.Inst.C.E., examined by Mr. GRAHAM MURRAY, said he had gone through the works, the mains, and all the property belonging to the Company, as well as their accounts for several years past. The Grahamston works he should consider were capable of manufacturing 450,000 cubic feet of gas per day; but the storage capacity, including the gasholder at Bankside, was only 350,000 cubic feet. Comparing the retorts with the maximum daily make, he did not consider they were in excess of immediate requirements. There was not the requisite margin of excess in the retort power to meet any extraordinary circumstances in the production of gas, or any casualty to the retort-settings. The East Bridge Street works were, in his opinion, entirely obsolete. By this he meant that, though gas could be made, it would be at such a cost as to preclude the economical use of the works. According to a table he had prepared, the cost of making gas at the East Bridge Street Works would be 5d per 1000 cubic feet more than at the Grahamston works. There was no exhauster, and the condensers were very old and antiquated in style, and inefficient for their purpose. One of the gasholders would contain about 48,000 cubic feet; and it was, he should say, practicable for the supply of Falkirk. The other two were too small to be serviceable. On the whole, it would not, in his opinion, be of any use to carry on the East Bridge Street works. The mains required entire rearranging so far as the streets of Falkirk were concerned. In High Street there were five mains, ranging from 12 to 2 inches in diameter; and in many of the streets, there were five, four, three, or two pipes, where one would be quite sufficient. The present arrangement of the pipes was uneconomical and bad. In almost every case where he had inspected the mains, he had found the ground smelling of gas. The state of the pipes was consistent with the amount of unaccounted-for gas. His valuation of the undertaking was based upon the quantity of gas sold in the last financial year, but not upon the price charged by the Company. The underlying idea of his valuation was to get at the net maintainable value—what any person taking over the concern would fairly suppose he would get year by year in future. He considered 3s. 6d. per 1000 cubic feet to be a fair average price. In arriving at this figure, he had taken the average of eleven Scotch towns about the size of Falkirk, and all more or less under similar circumstances—that was to say, they were all in the middle of what might be called the coal districts. In the year 1892, when coal was at its highest price, the average of the Companies he had taken was very little above 3s. 6½d. In the year 1894, after coal had been reduced, the average price came down to 3s. 4½d. Witness then put in the following table, showing how he arrived at his valuation of the Company's undertaking on the basis of 3s. 6d. per 1000 cubic feet of gas sold:—

Receipts.

52,639,300 cubic feet of gas sold, at 3s. 6d.		£9,211 17 6

Expenditure.

	Per 1000 Cub. Ft.	
Coals and Cartage, less residuals	1s. 2·00d.	
Working expenses	1 5·38	
Add for bringing up wear and tear to 5d. per 1000 cubic feet	0 1·35	
Add for extra expenditure necessary on main piping, in consequence of its multiplication and bad condition	0 1·60	
	2s. 10·33d.	
Deduct for discounts charged on expenditure side of profit and loss account, say	0 1·33	
Net cost of gas per 1000 cubic feet	2s. 9·00d.	
52,639,000 cubic feet of gas, at 2s. 9d.		7,237 18 1
Annual profit		£1,973 19 5
£1973 19s. 5d. capitalized at 16½ years' purchase		£32,899 10 3
Add value of East Bridge Street works		2,710 0 0
		£35,609 10 3
Deduct for—		
(1) New roof of coal-store, &c.	£440	
(2) Additional scrubber	400	
(3) Telescoping gasholder at Bankside	1050	
		1,890 0 0
Net valuation		£33,719 10 3

Examination continued: In his opinion, the Falkirk Company was no better security than any other non-statutory company in England or Scotland. No other non-statutory company in Scotland had been bought at a higher rate than 16½ years' purchase, with the exception of Alloa, where the concern was so small that there was no likelihood of competition. He had not included in his valuation the rental derived from meters; and there would naturally have to be added the value of such meters as the Company took over as a chattel at the valuation price on the day of transfer. The working expenses had remained fairly constant; so much so that the last year's working expenses came out just about the same as the average for the whole of the six years.

Mr. CORBET WOODALL: That is to say, the price of coal varied while the working expenses were constant?

Witness: Fairly uniform. They only varied a little; the extreme difference being 3d. over the whole period.

Cross-examined by Mr. BIDDER: The reason his figure for the cost of coal, less residuals, was lower than Mr. Lass's was, no doubt, because Mr. Lass divided up the cartage, whereas he had added to the cost of the coals the entire amount paid for the cartage. He had not had

any previous experience of valuing gas-works for the purpose of purchase under arbitration. He did not agree with the statement which had been made that for an expenditure of £4500 or £7000 the works at Grahamston could be made sufficient to produce 60 per cent. increase over the present make of gas. To begin with, the purifier would not be equal to more than 500,000 feet on Mr. Newbigging's own system of calculation; and he had not allowed anything for additional purifiers. The purifier could not be made a little larger. It would be necessary to put down two more purifiers at least, which would cost about £600. He had heard of retorts being charged seven times a day. But he had never heard of it being useful; and he did not know that it was frequently done. It would be necessary, in order to make the works equal to another 60 per cent., to have another exhauster. There would be some difficulty also in extending the retort-house, as there was not yard space enough to work conveniently. Additional ovens might be put up by doing away with the coal space; but if the house were crammed full of retorts, there would be no space to put the coal in, which would be absurd. The Company had been wise in having obtained additional ground, with the view to an extension in prosperous times. Supposing the works which had been mentioned were carried out at East Bridge Street, he still maintained that the works were badly situated for the conveyance of coal and for distributing gas in regard to level. It would also cost more for labour to make gas there than at Grahamston, by reason of the limited dimensions of the works, and the curious way in which the retorts were arranged in small settings of four and three. It would cost more for fuel to heat the retorts. They might turn gas out at East Bridge Street for 1s. 9·6d. per 1000 cubic feet. In the table he had put in of companies charging 3s. 6d. per 1000 cubic feet, he had selected them as being of similar size, and with a similar consumption of gas. It was perfectly true that six of them were not companies at all, but were gas-works in the hands of local authorities. There was very little inducement for the Corporation to raise the price of gas so as to make an adequate profit, as the consumers and ratepayers were for the most part the same people. He was aware that local authorities in Scotland were not allowed to make a profit. He thought it was quite fair, in making a comparison, to select concerns in the hands of authorities which were forbidden to make a profit, for two reasons. The first was that the local authorities could not, as a rule, charge a less price than the companies from whom they bought the undertakings, because of the larger amount of capital they required to have standing on the thing; and, secondly, because the Corporation who were going to acquire the works had to sell the gas without a profit, and, therefore, could not maintain the price the Company had kept up. He was not prepared to say that, if the price were reduced, there would be a corresponding increase of business. His only training in connection with valuation was that of reading and observation.

Mr. BIDDER: Does it occur to you, having had reading and observation, that the fair criterion for valuing property of this kind is what such property is bought and sold for?

Witness: I have based my opinion upon what has been done in previous cases—upon precedents; and I think that is what other witnesses have done, more or less. I do not look upon this as a compulsory sale. The Dumfries works were sold in 1878 at 15·17 years' purchase. The capital of that Company was £12,000 in shares and £2800 on loan. The dividend paid was 10 per cent. on the share capital; and the award amounted to £21,000. The Company were to clear off the loan itself; and therefore the net sum was £18,200—making 15·17 years' purchase. These figures he had taken from different sources—very largely from the reports in the JOURNAL OF GAS LIGHTING. He should not be surprised to hear that in the Coventry case in 1884 the number of years' purchase was 25, and the same at Stoke-upon-Trent. At Alloa, the number of years' purchase worked out at 18·6; but the award included the stock-in-trade. He should be surprised to hear that the Alloa works were sold at 23½ years' purchase. The Barnoldswick works were sold for 19½ years' purchase, and not 22½; at least that was the figure at which he worked it out. He did not know anything about the case personally. He remembered the Lancaster case; but he could not say that the number of years' purchase was 26⅔. He had every confidence in Mr. Stevenson's book; but he could not tell from it how many years' purchase the Lancaster undertaking was sold at, as he did not know the profits of the Company.

Mr. STEVENSON: The price was 26⅔ years' purchase; but there was an agreement, and it was a statutory Company.

The witness was cross-examined with regard to several other instances; but he stated that he had not had any personal knowledge whatever of them, except what he had taken from the JOURNAL OF GAS LIGHTING.

Re-examined: There was a great distinction between statutory and non-statutory companies. In order to compare like with like, he had taken non-statutory companies.

By Mr. CORBET WOODALL: The price of gas at Falkirk had been unjustifiably kept up, considering the reduced cost of coal. It was true the Company were not paying an unusual dividend, as it did not average quite 7 per cent. It was not an unjustifiable dividend.

Mr. CORBET WOODALL: I want to know in what way the Company kept up their price deliberately for the purpose of swelling the apparent profit?

Witness: My opinion is that the Company would not have kept up the price of gas unless they had had some such object in view, because, otherwise, why did they not have the price from the beginning of the six years, and always have such a price? I do not attack the Company at all for having raised the price of gas when coal was dear; but it certainly is my view that it was their duty to lower it when other companies did so.

In Mr. Field's "Analysis," from which you have been quoting, you have, in the same list of provincial gas companies, one with a capital at the rate of 4s. per 1000 cubic feet, and another with a capital beginning at nearly 24s. Would it be fair to say that the one was egregiously badly managed, and the other exceptionally well managed, simply because there is so great a difference in their capitals?—No.

Would it not be necessary to look into the conditions of each concern?—Yes; but I think it would be very possible, and very proper, to say that the one with a very heavy capital should not attempt to pay such a dividend as the one with a small capital, and, in order to do so, charge a very high price.

But whether we have a company with a capital of 19s. 10d. per 1000 cubic feet and a comparatively small company, do you think it follows that, because another company has a capital of 14s., therefore this one is to be regarded as an extravagant concern with excessive capital? Is it not fair, I mean, to take the circumstances of each individual case, and treat the company according to them?—Yes; but I fail to see that there are any exceptional circumstances in this case.

That brings me back to my first question—whether you can point to anything in the accounts of the Company for the year 1894 that shows the price to be fictitiously or unfairly kept up?—I can do that most assuredly.

I shall not ask for a comparison between 1893 and 1894; but, on the accounts of 1894, can you say that they have been wasting money in order to keep up the price, or that they have been putting an extravagant amount to profit?—Yes; I should say they have been putting an extravagant amount to profit. The balance of profit and loss account, as stated by the Company, is equal to rather more than 1s. 9½d. per 1000 cubic feet of gas sold. I do think that is an extravagant profit.

You agree that 9 per cent. was not a large profit?—I do not consider it an excessive dividend to pay, provided the Company's circumstances and conditions and capital expenditure are such as to warrant it.

Do you regard £6 something per ton of coal as extravagant capital for works of this sort?—No; I take it to be more than that.

It is under £7?—It is £950 per million cubic feet of gas sold. But there is this to be considered—that the quantity of coal carbonized is very large indeed in proportion to the quantity of gas sold.

I quite agree. You know that 1·6d. per 1000 cubic feet represents about £350 a year, does it not?—I will take it from you.

You take that as about a fair allowance for maintaining mains, service-pipes, and so on?—Yes; I do.

But then you add another £350 a year, because there are surplus mains?—Yes.

How much would it cost, do you think, to cut out all these surplus mains and remove them?—I estimate that to put the piping (almost the whole system of piping) and other work which is needed into a thoroughly efficient condition would cost £3000.

It would pay the Company to spend £7000 rather than continue to pay £350 a year, would it not?—But I consider that they need to continue to pay this in perpetuity, so long as the mileage of mains bears anything like the same proportion to the consumption of gas.

This extra 1·6d. was owing to the condition of the mains and their duplication. You say that for £3000 you could put that all right?—I rather misstated that when saying that it is due to the condition and multiplication of the mains, because, in a sense, it is not even due to the excessive length of mileage of the mains. It is partly due to the nature of the district, and partly to the multiplication of the pipes.

Friday, Dec. 21.

Upon the inquiry being resumed to-day,

Mr. *A. Gillespie*, examined by Mr. WILSON, said for upwards of 30 years he was Manager of, and partner in, the Barrowfield Iron-Works, known as the firm of Messrs. Laidlaw, Sons, and Caine, of Glasgow. Since January, 1891, he had been in practice as a consulting engineer. He had had experience in designing, constructing, and estimating the value of all kinds of gas-works. He had prepared a statement as to the structural value and present condition of the works and plant belonging to the Falkirk Gas Company. He had gone into the details of the whole of the buildings and apparatus. Speaking generally, he could say that the Grahamston works were in very fair condition; but the situation was unfavourable for railway communication. There was no room for extension on the present site. The East Bridge Street works were not in a good state for working. The machinery was entirely out of date, and, what was more, it was not in repair. The total output of gas in an emergency from these works, supposing certain alterations were made, would be 80,000 cubic feet; but this quantity could not be kept up. He had valued the undertaking as a going concern. The original value he put at £42,796; and the present value, at £34,621, inclusive of land and cottages.

Cross-examined: All he had done was to carry out his instructions—viz., to make a structural valuation. At the Grahamston works, there was room for adding a scrubber, but not for extending the purifiers. Purifying accommodation, according to the present rate of increase, would last for four years. This was estimating the annual increase at 5 per cent. Most of the works were in excellent condition.

By Mr. CORBET WOODALL: He would advise a complete abandonment of the East Bridge Street works, and either the sale or the removal of the large gasholder and tank. He was aware that a gas company must have a certain amount of reserve power.

Mr. CORBET WOODALL: Would you advise the abandonment of works already existing, equipped and ready to be lighted up at an hour's notice, and the building of new ones in place of them, when they are only wanted for reserve?

Witness: Well, there is not any apparatus worth keeping in this way. There is no exhauster; and the moment you put in an exhauster, you must get new purifiers. The works would answer their purpose as a reserve until Grahamston came to its limit, which it would do in four years.

By Mr. STEVENSON: It was not an advantage to have the reserve power at some distance from the works in operation. As a storage station, the gasholders, being of small size, could not be worked economically from any other place.

Mr. STEVENSON: In your opinion, the East Bridge Street works are of no use at all in an emergency, save the gasholders?

Witness: Save the gasholders, which might be kept for the life of Grahamston. It is a question for the parties they belong to, whether they will keep them as a reserve for four years. But in that time Grahamston will have reached its limit; and it is of no use keeping them as a reserve.

Mr. *F. T. C. Linton*, in answer to Mr. BALFOUR BROWNE, said he had visited the Falkirk Gas-Works, and had made a careful examination of them, extending over two days. He agreed with other witnesses

that the Grahamston works were in fairly good condition, though the space was exceedingly limited. The East Bridge Street works were in a very worn-out state—in fact, they were of a very primitive kind. These works ought merely to be treated as a stand-by only to be used when they had to provide gas, whatever might be the cost of making it. His structural valuation of the works at the present time was £33,757. Taking 3s. 5d. as the proper price to charge the consumers, it gave £9193 12s. as the fair maintainable revenue from gas. In this sum, he had deducted the rentals derived from houses; because his view was that, if they were to be purchased by the Corporation, they should be valued and paid for separately, as they were not necessary to the manfacture of gas. The profit of the year, as stated in the accounts, was £4774 2s. 7d.; but he had made the following calculations:—

Gas	£1751 11 1
Rents of houses	90 15 0
Undercharge on repairs, maintenance, and renewals	655 12 2
Directors' fees	134 0 0
Total	£2631 18 3

This amount deducted from the £4774 2s. 7d. gave £2142 4s. 4d. He therefore valued the undertaking as a property capable of producing a maintainable income of £2142 4s. 4d., which, at 18½ years' purchase, worked out to £39,361 0s. 2d.

Cross-examined: Had more care been taken in eliminating duplications, and maintaining the pipes in proper and sound order, especially the service-pipes, the leakage would have been very much less. The meters should also have been overhauled, when the working would have shown a much more profitable result. It would pay to get the pipes put into more perfect order. There should be no difficulty in bringing down the leakage to one-third of what it was. He was aware there was no statutory prohibition in this case as to price; but he believed the inhabitants of the neighbourhood would not continue to use gas if the price were put up. They had a very decided hint in that respect in the case of the Asylum, by the reduction in the quantity of gas consumed last year. He disputed the proposition that there was a very general falling off in the consumption of gas in many burghs in Scotland last year. The result of the deductions which he had made would be to leave the Company with a profit of £2142, or just 4 per cent. upon the capital. He thought this was fair and reasonable, because, in the first place, the Company were, on the one hand, water-logged with a heavy amount of capital expenditure, and therefore must be content with a smaller dividend than one not so weighted; and, on the other, he considered that in their working results they might have very much improved their position. If they had worked up to the level of other companies, they might have had 2 or 3 per cent. added to the dividend. A statutory company generally looked for 10 per cent. as a proper return. If the Company were to charge a price for their gas which would give them 10 per cent., it would be such an excessive one that it would certainly produce opposition; and their history showed that they had never ventured to try anything of the kind. They had had to be content with a great deal less dividend, because they found they could not venture upon more. It was not until the previous year that they had had anything like a figure approaching 10 per cent.

By Mr. CORBET WOODALL: The mains were in a very leaky condition. A mere reduction in their length would undoubtedly reduce the quantity of unaccounted-for gas. One might have a very great extent of mains proportionately without any increase of leakage. When he went to Leith, about 27 years ago, the leakage was 22 per cent. In those days, so much was accepted as being the inevitable—the average thing to have. He did not quite agree with this; and he obtained the permission of his Directors to have a thorough overhaul of the pipes and services, and also of the meters. The result was that the figure at which he had arrived was 5·9 per cent. But he went farther, because he wished to analyze, if he could, what this 5·9 per cent. amounted to—whether it was really leakage, or whether there was something else in it. He had thermometers put in the mains all over the town; and they were read three times a day. He kept this up for three years; his purpose being to see how far the shrinkage of the bulk of gas accounted for it. The result was that, checking the gas as it was being registered at the works, they found it to be at a temperature of 55° to 60°. He found the average temperature at which it was being measured by the consumers' meters, or leaving the mains, was only about 45° to 53°—taking into account what the temperature was during the cold weather in winter. The result was that there was a difference of about 15° between the works and the consumers' meters, which meant 3 per cent. He therefore arrived at the result that about 3 per cent. was really shrinkage in bulk, and the other 2·9 per cent. was leakage. A large waste could not be avoided. The workmen must be employed attaching service-pipes, which would account for a good quantity. Gas was lost at the works; and then there was the violent fracture of pipes, which occurred now and then by drainage operations, and so forth. If these were taken away, the real leakage became quite imperceptible. What he had done in this way would be a profitable thing to do in Falkirk, unless there were any underground workings or the like.

Mr. *W. W. Neilson*, Burgh Surveyor of Falkirk, stated that he had made plans of the gas-works, which he now produced and verified. He had also prepared plans showing the lines of piping belonging to the Company; and one of the district, indicating the extent of the duplicate mains. As Superintendent for the Falkirk and Larbert Water Trustees during the past 16 years, he had had many opportunities of seeing the gas-pipes exposed; and his opinion was that most of them had been put in about 60 years ago. Some were laid in a most slovenly manner. There had been an improvement since the present Manager came. Looking at the condition of the pipes generally, he thought that in future there would be a good deal to do in the way of pipe laying. The high price of gas lately had affected its sale. In several of the new houses, gas-fittings were not being put in.

Cross-examined: He did not suggest that the Company were making a false statement when they said they had recently had a large number of applications for gas; but he did say it was very extraordinary that so many should have come in just now.

Mr. *Charles Hunt*, M.Inst.C.E., said he had been in many cases engaged in valuing gas-works for the purposes of sale and otherwise. He was one of the witnesses on behalf of the Falkirk Commissioners when the proceedings took place before the Select Committee of the House of Lords; and prior to that he had inspected the district for the purpose of giving evidence. His examination showed that the pipes were in a defective condition; and most of them were admitted to be very old. Since the amalgamation, apparently no attempt had been made to unify the system of distribution. Many of the mains were very small, which was unsatisfactory, and must lead to increased leakage. Small pipes were much more liable to fracture than larger ones. Several of the pipes were nearer the surface than he should lay them. He was not at all surprised, under the circumstances, that there was a considerable loss through leakage; and 22·61 per cent. was a large proportion. The Grahamston works were in fairly good condition; but the East Bridge Street works he did not regard as of any value. He admitted that, with a certain amount of expenditure, gas could be made upon them; but he thought that it would be a most imprudent thing to expend a penny on them, having regard to the capacity of the Grahamston works, and to the certainty that new works would be almost immediately required. He regarded the capital account, which stood at £50,000, as excessive, considering the present value of the undertaking. The production of gas per ton of raw material carbonized was lower than he should have expected to find from a mixture of shale and splint coal. In determining the value of a non-statutory company, having no fixed dividends by which the profit might be defined, it was necessary to take into consideration all the conditions under which the profits might be reasonably expected to be maintained. It was not right merely to take as the measure what had been earned. It was easy to cover up the defects of indifferent management by unduly advancing the price of gas. It was very easy to show a profit by raising the charge for gas, although the management might be indifferent. The plant and appliances for manufacture and distribution were not so efficient as they could be made; but that was no justification for the present high price of gas. He had arrived at the value of the works by taking the income or the profits earned during the year ending May 15, 1894, and making corrections upon it. The profit, as shown in the balance-sheet, was £4774 2s. 7d. To this he added income-tax, and interest on loans; making the total £4956 13s. 11d. From this he deducted rents of cottages, £90 15s.; directors' fees (the average of two years), £134; then the difference between the amounts charged for repairs on works and meters, and depreciation and renewals—6½d. per 1000 feet of gas sold,—which came to £657 13s.; then the difference between that which was actually charged and an all-round figure of 3s. 6d. per 1000 cubic feet. It was quite right for the Company to increase their charge when the price of coal went up; for almost every company did the same. But, in the natural course of things, when those exceptional circumstances disappeared, the price should have been reduced. He had little doubt that this would have been done had it not been for the circumstance that the Company were contemplating an application to Parliament. The difference in the price of gas would thus amount to £1915 0s. 5d.; making a total amount of deductions of £2797 8s. 5d. This left a net balance of £2159 5s. 6d. Capitalizing this at 18½ years' purchase gave a total of £39,947 7s. 2d. From his experience and knowledge of the works, he should say this was the full value of the undertaking.

Mr. BIDDER (in cross-examination): Where do you get your 18½ years' purchase from?

Witness: I assume that a statutory company under the same conditions—that is, practically at the end of their tether—would be worth, to purchase, from 22½ to 25 years of the dividend, according to circumstances; and I deduct from that value 20 per cent. to bring out my 18½ years. The 20 per cent. is the difference between statutory and non-statutory companies.

In further cross-examination, witness said he did not think the East Bridge Street works were such as it would be profitable to carry on as a regular thing. Gas could be made in them, so that they might be called a stand-by. He should not hesitate for a moment, in the case of an accident or breakdown at Grahamston, to use the East Bridge Street works in order to meet the requirements of the district. A margin of 20 per cent. was wanted to meet a case of this kind. It would be unsafe for any company to work up to the full limit, for fear of an accident. In the case of Stourbridge, where the works had recently been sold to the Improvement Commissioners, the Company had a margin of 20 per cent. He was a witness at that arbitration. Between 28 and 29 years' purchase was allowed by the Arbitrators, notwithstanding that he expressed the opinion that they ought to have had 31 years. Witness added that he pointed out in that case what great depreciation there had been in all classes of investments; amounting during the last 18 years to something like 30 per cent for first-class securities.

Re-examined: In the Stourbridge case, which was one of compulsory purchase, he appeared on behalf of the Commissioners. He saw nothing in the evidence he gave in that case which conflicted with what he had just said as to 18½ years' purchase. In every case of sale and purchase, one must look at the whole of the circumstances. There was no rule that a certain number of years' purchase should be applied to every case.

Mr. CORBET WOODALL: You say that the plant at Grahamston is not so good as it could be made. But how many companies in the United Kingdom would not be in the same position, think you?

Witness: I never studied that problem, for I do not know the condition of more than perhaps 50 or 100 out of 500 or 600 companies.

Of those?—I should think one-half.

One-half are as good as they can be made?—I should say so.

I should say 95 per cent. In regard to the producing capacity of the works at Grahamston, according to you they are equal to making 500,000 cubic feet of gas a day?—Yes, by drawing upon the reserve.

At the full?—Yes; that is with the 90 retorts working.

Would you make the 500,000 cubic feet a day that can be made at Grahamston, keeping the East Bridge Street works as your reserve, or would you at once proceed, as soon as you encroached upon your reserve by 15 or 20 per cent., to erect new works?—I should at once proceed with new works. I would not spend a penny on the old ones.

Mr. *J. D. Lawrie*, a member of the Edinburgh Stock Exchange, stated that there was no market for the shares of what were termed private companies. One practically had always to communicate with the Secretary of the Company in order to find a local buyer. In the case of the Coatbridge Company, which was incorporated in 1877, and was a statutory Company, the shares paying 10 per cent. were quoted at £180, and the 7 per cent. shares at £126 5s. Calculating the return at these prices, it came to £5 11s. 1d. for the 10 per cent., and £5 10s. 11d. for the 7 per cent.—almost the same. But then there was an allowance which ought to be taken into consideration on account of the accrued dividend; and doing this increased the returns to £5 13s. 8d. and £5 13s. 7d. respectively. This gave the value, as a percentage investment, as well as the Stock Exchange or the facilities of the market could give it. He had no hesitation in saying that a non-statutory company would not be so valuable as a statutory one, and a non-quoted company not so valuable as a quoted one.

Mr. *J. Wilson*, Town Clerk of Falkirk, was called to prove that his firm had advertised shares of the Company in January, 1894, and received two offers at £2 per share; but ultimately the purchaser refused to complete. In September last, advertisements appeared in the *Falkirk Herald* respecting 150 Falkirk gas shares at 38s.; but no sale took place.

Cross-examined: In January, 1894, he sold some at £2 14s.

Mr. *R. Baird* said he was trustee of a Trust Estate, and had tried to dispose of 197 shares; but could not get a bid of 40s. for them.

This closed the evidence on behalf of the Commissioners.

Mr. BIDDER then proceeded to address the Arbitrators on behalf of the Company. He first dealt with the point whether the cottages which were owned by the Company should be excluded from the award, and said that, according to the Act of Parliament, the Commissioners were to buy, and the Company to sell, "the undertaking of the Company," and not, as some of the witnesses seemed to think, merely the gas-works. Therefore, any distinction between what was and what was not necessary for the production of gas was perfectly illusory. The rents of the cottages and the meter-rents were clearly part of the undertaking, and formed part of the capital owned by the Company from the commencement. They could not carry on their business unless they owned a large stock of meters; and therefore it could not be right to exclude them altogether, though he did not object to their being valued on a separate basis. It was now agreed that the capital expenditure of the Company, or indeed the structural value of the works, was immaterial for the purpose of arriving at the correct sum to be paid. The earning power—the yearly profit—of the thing that was being sold was the criterion of its value. The next point on which all the witnesses seemed to be in accord was that, having regard to the progressive character of the business, the year 1894 should be taken as the standard, though no doubt there was some divergence of opinion as to the deductions which should be made from the profit of that year. He admitted that the accounts had not been very scientifically kept, in the sense that one year's accounts had been made to bear the cost of repairs done in another year. The figure of 5d. per 1000 cubic feet had been generally adopted by the witnesses as the sum to take off for depreciation and renewals, though one witness said that 1d. more should be allowed because of the leaky condition of the mains; but it was also stated that the accounts of 1894 ought to be rectified by including the expenditure on the mains that was necessary to get rid of the leakage. Then with respect to the price charged for gas in 1894, it had been suggested that no reduction was made because of the Bill in Parliament for the purchase of the undertaking. But it should be remembered that the greater part of the year had expired before there was any whisper in regard to that Bill. The figure of 3s. 5d. had been put as the average price charged in the case of a number of similar gas-works in Scotland. But it turned out that many of these were owned by corporations, who were not allowed to make a profit; and this fact would have a great effect on the average. Then, again, many of the companies that had been quoted might be said to be sitting on the top of the coal; and the towns they served had a more compact population than that of Falkirk. With regard to what the Company were fairly entitled to return to their shareholders as profit, it was monstrous to say that only 4 per cent. on the capital should be allowed, in face of the fact that they had been making and dividing an average of £3000 a year. Fault had been found with the condition of the mains; but, after hearing the evidence of Mr. Linton and Mr. Hunt, who said that the mains were in very good order, he should not further discuss that point. Then reference had been made to the high percentage of leakage; and it had been said that the production of gas per retort was very low, and that the scrubbers and exhausters were insufficient. But even if this were so, the profit he was dealing with was earned in spite of all these defects. If it were clearly made out that the management and working were bad, it only went to show that, with improved management, larger profits might be obtained. The learned Counsel then commented upon the injustice of the Commissioners assessing the Company on a valuation of £4150 a year, and afterwards contending that they were not earning more than £2000. There was a cynical indifference in the proceeding, which he was surprised to find even in the Commissioners of a Scottish burgh. After referring in detail to the evidence which had been given as to the number of years' purchase adopted in the cases of Alloa, Rhyl, Stourbridge, Tain, and other places, and explaining the circumstances of each, he contended that 23 years' purchase was the proper multiplier to employ in the present instance. As to the price at which there had been transactions in the shares, he contended that it was depreciated by the action of the Commissioners, who were threatening to enter into competition with the Company. Then as to whether 10 per cent. should be added to the purchase price as compensation for forced sale, it had become the universal custom, which had been recognized for many years, to allow this, though there was no law which said that it should be added. It had been disputed that this was a compulsory sale; but he should contend that the Company were forced to sell by the Act of Parliament. The first notice issued by the Commissioners was couched in terms which were not in accordance with the view of a compulsory sale; but the Court instantly restrained them from proceeding until they had altered the notice to make it conform to the Act.

Mr. BALFOUR BROWNE then replied on behalf of the Commissioners. In the first place, he denied that they, in buying the undertaking, were bound to purchase the cottages. Parliament had imposed upon them the obligation, before they commenced to supply gas, of purchasing the existing gas-works; but this did not mean that they should be compelled to buy all the dilapidated house property owned by the Company. Dealing with the capital, he contended that it had been very much inflated. Instead of being studiously moderate in their claim, as his friend had contended, they had done their best for one year, by three or four different methods, to get their works to an absolutely extortionate price. In 1892 the Company were charging 3s. 3d. per 1000 cubic feet; and it was admitted that they were quite justified, by the price of coal, in going up to 4s. 2d. in 1893. But he should contend that they were not justified in keeping up this figure in 1894, when coal had become cheaper. The price of 4s. 2d. would not have been maintained but for the fact that they were going to Parliament. Mr. Newbigging had practically admitted this because he said it was a question of policy. All the other companies who were not threatened with purchase had reduced their charges. Regarding the price which it was said the shares had realized lately, he pointed out that they were mostly purchased by Directors and officials of the Company, who made the purchases in order to inflate the value of the shares. As to the point that had been made about the rating, he contended that the assessment was made on the inflated profit put forward by the Company. One reason why they were able to continue the price of 4s. 2d. was that, from the very first notice issued by the Commissioners, they were protected from any possibility of competition. The right correction to make in the profit in respect of the exorbitant price charged for gas was that made by Mr. Linton and the other witnesses—viz., £1700. Then, again, the maintenance charge should be put at 5½d., and not 5d. per 1000 cubic feet; and there should be an alteration in the allowance for Directors' fees. After making these changes, the net maintainable profit would come out at £2014 6s. 8d. As to the multiplier which had been contended for by the Company, none of the witnesses called by them had been able to give an instance of anything like such a figure being adopted. Dealing with the 10 per cent. which it had been claimed should be added for compulsory sale, he contended that it was not compulsory at all. The Company were perfectly willing sellers. The only other remark he would make was with reference to the way in which the capital account had been swelled by putting to it things that ought to be charged to revenue; thus making the profits last year look larger than they really were. The Company had failed to make out their case in three particulars. They had inflated the price of gas, and kept it up improperly; they had not written off sufficient for depreciation and repairs; and they had not put the Directors' fees into the account. Therefore the true maintainable value of the undertaking could not be arrived at without an adjustment of the account, which, he contended, would bring the annual value to something like £2000, which ought to be capitalized at $16\frac{2}{3}$ years' purchase.

Mr. BIDDER said he should be quite content if the Arbitrators would deal with the cottages separately in their award.

Mr. BALFOUR BROWNE said he would take Mr. Black's valuation for the cottages, which he believed to be perfectly fair.

Mr. BIDDER suggested that all cash and debts should be the property of the Company; but that all stocks and meters should be paid for at a valuation.

Mr. BALFOUR BROWNE said this seemed perfectly fair.

Mr. BIDDER then asked as to the date of transfer. He said he should like a certain day to be fixed, because there was a question as to the division of the profits for the current year.

Mr. STEVENSON suggested the next financial quarter-day.

Mr. BIDDER did not object to this. The Company would, he said, manage the business and retain the profits until that time.

Mr. BALFOUR BROWNE remarked that, of course, the Company were bound to keep up the works properly until the transfer.

The proceedings then concluded.

The following is the text of the award, after reciting the terms of the Arbiters' appointment: "*First*.—We fix and determine the value of the undertaking of the Falkirk Joint-Stock Gas Company, Limited, including the house and cottage property belonging to the said Gas Company, as valued by William Black, Architect, Falkirk, and that free of all obligations and incumbrances of every description, except the feu duties or ground-rents, which may affect the property, to be the sum of seventy-seven thousand and fifty pounds, payable on the second day of February, eighteen hundred and ninety-five, which is hereby declared to be the term of entry to the undertaking by the said Commissioners, with interest on said sum at the rate of five per centum per annum from the said second day of February, eighteen hundred and ninety-five, till payment; in payment of which sum and interest, we find the said Commissioners liable to the said Gas Company. *Second*.—We find and direct that the said Commissioners shall take over at a valuation the whole of the stock-in-trade as at the said second day of February, eighteen hundred and ninety-five, consisting of coal, coke, tar, liquor, and lime, and the wrought-iron pipes, fittings, fire-clay goods, and tools in store. *Third*.—We find that no further capital expenditure is to be made by the said Falkirk Joint-Stock Gas Company, Limited, without the consent of the said Commissioners of the Burgh of Falkirk. *Fourth*.—We find that the said Commissioners of the Burgh of Falkirk are liable in the expenses of the arbitration and incident thereto, as the same shall be taxed by the Auditor of the Court of Session. And we decern and ordain both parties to implement and fulfil this decreet arbitral in all points; and we direct the same to be registered in the books of Council and Session or others competent." The document is signed by the Arbiters and two witnesses.

Holt Gas-Works.—We learn that Messrs. Crowther Bros., of Poplar, have acquired the freehold of the Holt (near Wrexham) Gas-Works; and the business came under their control on the 1st inst. Mr. David Crowther will reside at the works; but this change will not in any way affect the firm.

METROPOLIS GAS SUPPLY.

The Quality of the Gas during the Past Quarter.

The following is an abstract of the report of the Chief Gas Examiner for the Metropolis (Dr. A. W. Williamson, F.R.S.) as to the quality of the gas supplied by The Gaslight and Coke, Commercial, and South Metropolitan Companies, during the quarter ending the 31st ult.:—

I. *With respect to Illuminating Power.*—The average illuminating power, in standard sperm candles, at each of the testing-stations, was as follows:—

The Gaslight and Coke Company—	
Fenchurch Street, E.C.	16·6
Kinghorn Street, E.C.	16·5
Dorset Buildings, E.C.	16·8
Ladbroke Grove, W.	16·5
Devon's Road, E.	16·2
Carlyle Square, Chelsea, S.W.	16·2
Camden Street, N.W.	16·3
George Street, N.W.	16·1
Graham Road, E.	16·6
Kingsland Road, E.	16·6
Spring Gardens, S.W.	16·2
Grove Gardens, St. John's Wood, N.W.	16·1
Hornsey Road, N.	16·3
Lambeth Road, S.E.	16·1
Millbank Street, S.W.	16·6
Commercial Gas Company—	
Parnell Road, E.	16·1
Wellclose Square, E.	16·3
South Metropolitan Gas Company—	
Hill Street, S.E.	16·5
Bedford Road, S.W.	16·2
Stoney Lane, S.E.	17·0
Lewisham Road, S.E.	16·3
Blackfriars Road, S.E.	16·2
Burrage Road, S.E.	16·3

It will be seen from these results that the average illuminating power of the gas has been higher than the parliamentary standard at all the testing-stations, especially the Stoney Lane station of the South Metropolitan Gas Company, at which testing-place the minimum lighting power of the gas was better than the requirements—viz., 16 candles. At the Dorset Buildings, Millbank Street, Ladbroke Grove, Graham Road, and Kingsland Road stations of The Gaslight and Coke Company, the minimum was also better than the requirements; and it was equal to them at the Devon's Road, Carlyle Square, Camden Street, Spring Gardens, and Lambeth Road testing-places of The Gaslight and Coke Company, and the Hill Street, Lewisham Road, and Burrage Road stations of the South Metropolitan Gas Company. Slight deficiencies of lighting power were reported in the gas tested at the Grove Gardens, George Street, and Parnell Road stations.

II. *As regards Purity.*—Sulphuretted hydrogen has not been present in the gas at any of the testing-stations. The average amount of sulphur in other forms than this was considerably less than the quantity permitted—viz., 22 grains—at all the testing-stations, more especially at the Millbank Street, Ladbroke Grove, Devon's Road, Graham Road, and Lambeth Road stations of The Gaslight and Coke Company, the two stations of the Commercial Gas Company, and the Hill Street station of the South Metropolitan Gas Company, at which places the average amounted to less than half the quantity allowed—viz., 22 grains. Ammonia has been generally present in the gas at all the testing-stations more or less frequently during the quarter; but only in slight quantities. The amount allowed was not exceeded on any occasion during the quarter.

Jan. 10, 1895. (Signed) ALEX. W. WILLIAMSON.

The New Water-Works at Lurgan.—Mr. C. P. Cotton, the Engineering Inspector of the Local Government Board for Ireland, held an inquiry at Lurgan a few days ago respecting an application by the Town Commissioners for permission to borrow an additional sum of £2000, required in connection with the new water-works. There was no opposition on the part of the ratepayers.

The Transfer of the Accrington Gas and Water Undertakings to the Local Authorities.— On the 31st ult., the undertaking of the Accrington Gas and Water Company was formally handed over to the new Gas and Water Board, representing the borough of Accrington and the districts of Church, Clayton-le-Moors, Rishton, and Great Harwood. The Mayor of Accrington (Alderman Haywood) and the members of the Joint Board met the Directors of the Company at the offices. Addressing a parting word to the Directors, his Worship congratulated them and his colleagues upon the completion of the negotiations. During the past year, he remarked, the waves of litigation had dashed pretty high; but fortunately, by the exercise of wisdom on both sides, an arrangement was arrived at by which the Company's undertaking became the property of Accrington and the four adjoining Local Boards. It was a termination to which no one could take exception. The terms were indeed high; but the undertaking was valuable. Although fault had been found with the action of the Directors in the past as to the disposal of their revenues, the purchasers would derive the benefit of being the recipients of a plant and material which were in perfect working order. The Mayor then handed to the Directors a cheque for £5000 (as agreed upon in the terms of settlement), to be applied to the remuneration of the Company's old servants and the Directors for the loss of their salaries. The seal and deeds of the Company were then transferred to the Clerk of the Joint Board, and other formal business connected with the winding up was transacted. Readers may be reminded that the purchase of the undertaking was mutually agreed upon nearly two years ago, and was confirmed by Act of Parliament passed last session. The purchasers are to pay the shareholders perpetual annuities equivalent to the maximum dividends of 10 and 8 per cent.; representing, capitalized, a sum of upwards of £600,000.

THE PLYMOUTH CORPORATION AND THE GAS COMPANY.

The Alleged Nuisance—Threatened Prosecution.

Among the business on the *agenda* for the meeting of the Plymouth County Borough Council yesterday, the question of the alleged nuisance at the works of the Plymouth and Stonehouse Gas Company had a prominent place. The Sanitary Committee report that, in answer to their representation, Dr. A. C. Fryer, the Inspector under the Alkali, &c., Works Regulation Act, wrote that he has visited the houses from which the complaint arose, and is now of opinion that the nuisance to which the inhabitants refer has not been caused by any escape of fumes from the manufacture of sulphate of ammonia. Other processes carried on at the works do not come under the supervision of the Act. He understands, however, that every possible precaution will be taken to minimize the annoyance complained of. The Gas Company have, he adds, recently erected a new sulphate of ammonia plant. The working of it was new to the men in charge; but, as they are now more experienced, and as the precautions which the Act demands have been carefully attended to, no continued annoyance is to be feared from this source. A report presented to the Committee by one of the Corporation officials also stated that the Directors of the Gas Company were executing certain works, with a view to the abatement of the nuisance. The matter thereupon stood over until a subsequent meeting of the Committee, when it was reported that the opinion of Counsel (Mr. W. Graham) upon the case stated by the Town Clerk in relation to the alleged nuisance had been received. Mr. Graham is of opinion that the Corporation have power to compel the Directors of the Company to abate the nuisance, and to prevent the recurrence thereof. The Town Clerk also reported that he had communicated with the Company further as to the abatement of the nuisance, but had had no reply; and inasmuch as complaints continued from persons residing or carrying on business in the neighbourhood of the gas-works, and the nuisance had not been stopped, he intended to act on the instructions given to him last month by applying to the Attorney-General to institute proceedings on the relation of the Corporation for the abatement of the nuisance. The Sanitary Committee thereupon resolved that notices be given to abate and prohibit the recurrence of the nuisance, and that, in default of compliance, complaint be made by an Inspector of Nuisances before a Justice, and necessary proceedings taken to enforce compliance.

THE OIL-GAS EXPERIMENTS AT THE BRADFORD GAS-WORKS.

At the Meeting of the Council of the County Borough of Bradford on Tuesday last, a statement was made with reference to the oil-gas experiments which are being conducted at the Thornton Road Gas-Works.

On the presentation for adoption of the minutes of the Gas Committee,

Mr. J. COWGILL asked for a report on the experiments, and said he wished to know whether they were being carried out entirely according to the agreement with the Corporation.

Mr. W. C. DIXON, the Chairman of the Committee, in reply, said that, he had been taking some little interest in this matter; and he was only very sorry that he should have to arrive at the conclusions he had done. He had from time to time received a few off-hand reports with regard to the progress which was being made, and especially as to the bye-products, to the effect that the results were "marvellous," "passed all expectations," "exceeded anything that was anticipated," and all that sort of thing. He had had his own doubts on the question from the observations he had been able to make; and he asked the Gas Engineer (Mr. Wood) if the process would be of any use, and also to test the quality of the residuals for permanency. He suggested at the same time that a holder should be filled with the gas and tested. The Engineer said that they had already at the works in Thornton Road a holder partly filled with gas enriched with the bye-products, so a time was fixed for this to be tested. Dr. Dvorkovitz was present; but it was found that the test could not be made that afternoon, and so he (Mr. Dixon) visited the works the next morning—Dec. 5—to see the test made. The first thing he learned was that a telegram had come from the Doctor (who had gone to London) objecting to the test being made. The gas had been put into the holder for the special purpose of the test; and if he (the speaker) had not mentioned it, the test would have been made by the officials themselves. The first test was made by Mr. Dawes, whose business it was to do nothing else but test the gas. The gas was put into the holder at 18·25-candle power; and in the test it gave the extraordinary figure of 15·6-candle power, showing that the enrichment had absolutely gone, and that there was not a particle left. He was then going away, when the Deputy-Chairman came in, and so it was proposed to make another test. He should have felt satisfied if the same man whose business it was to test the gas had made the second test also, but this was made by Mr. Sutcliffe, the Manager of the Thornton Road Gas-Works; Mr. Wood and Mr. Dawes taking part in it. The result obtained was 16·8 candles. Two tests were thus made, with the result that an average loss of 2·05 candles was recorded. So that it was clear there was not that enrichment about these residuals that was claimed for them. In order to fortify himself on this point, he obtained a bottle from the office, and took some of the residuals and sent them to be analyzed. The result was to bear out the test which he had seen made. He cautioned Mr. Wood at the time to be perfectly sure of his figures; for, as far as he was concerned, if the process were proved to be doing what it was said it did, he was just as much in favour of it as Mr. Wood or anyone else. Dr. Dvorkovitz had been leading him to suppose that he thought so highly of the bye-products that he could afford to let the gas blow away in the air for the sake of the products; but the fact was that they had ceased using these residuals. The last conversation he had with Mr. Wood was to the effect that they had been testing the gas at the Mill Street works; and it had not been satisfactory. He thought this put Mr. Wood in a false position, after making

statements to his own Committee that it exceeded expectations. He did not think that Mr. Wood had had time to fairly settle the question in his own mind. Consequently, he was not justified in giving reports to the Committee. They had found out after the experiments had been going on for two months that they were making too much of the bye-products—that valuable commodity!—and they had started a fresh system of making more gas and less residuals. Dr. Dvorkovitz had reported in the newspaper that they were making 17,000 cubic feet of gas per ton of oil, and that all the enrichment at Thornton Road recently had been by the oil process, and that there had been no cannel coal used. He wanted to take a test of his own as against the scientific method of testing; and as on Nov. 16 and 17 the plant was standing for want of oil, this gave him the opportunity he desired. He noted the condition of the meter as it then stood; and after the work commenced again on Nov. 19 he made various tests from time to time up to Dec. 8. From Nov. 19 to Nov. 28, the average make of gas per day was 6317 cubic feet, or a total make of 56,850 feet. The next test was made on Dec. 8, by which time it was calculated that 14 tons of oil had been used since Nov. 19; and it showed that an average of 8964 cubic feet of gas had been made per ton of oil. On Dec. 12 he again went to the Thornton Road works; and the stock of oil was then coming to a finish. The oil came in in two separate lots of 9 tons 8 cwt. and 8 tons 6 cwt. respectively; and the second had been added to the first without waiting to ascertain the result of the working of the first lot. He then gave instructions that no more oil was to be put into the tank until he ascertained the result of the experiment. The remaining oil was then pumped out, and was found to measure 317 gallons, or 1 ton 5 cwt.; so that exactly 16 tons 9 cwt. had been consumed. The total amount of gas made was shown by the meter to be 193,100 feet; so that, although they had been increasing the amount of gas and decreasing the residuals, the average make of gas was 11,738 feet per ton. This he was able to prove by the very books of those who had conducted the experiments. So far as he could see, no more conclusive test could be applied than this; and it differed in its result from Dr. Dvorkovitz's claim by no less than 5270 feet of gas per ton of oil used. He thought himself that it was about time that the Committee should be supplied with information of what was really going on.

Mr. T. CROSSLAND said that, on the showing of the Chairman of the Gas Committee, there was something radically wrong in the reports issued on the oil-gas experiments; and he thought that the Engineer should be asked to present a report on the matter.

The minutes were adopted.

A Reply by Dr. Dvorkovitz.

Dr. Dvorkovitz has written to the *Bradford Observer* commenting as follows upon Mr. Dixon's statement:—

1. Mr. Dixon does not question the fact that, as the result of my process, ordinary coal gas was enriched up to fully 18-candle power. His statement, indeed, is that the enriched gas was put into the holder at 18·25-candle power. He, however, alleges three objections to the adoption of my process; and with these I will now deal. They are: (1) That the enrichment is evanescent, not fixed; (2) that the quantity of gas obtained from a ton of oil had been overstated; (3) that the value of the residuals or bye-products had been exaggerated. The first of the above objections is based on a test said to have been applied in Mr. Dixon's presence on the 5th of December last; and its effect, as stated in his speech, was to show that gas put into the holder at 18·25-candle power was diminished to 15·6-candle power. This single test satisfied Mr. Dixon that the enrichment had absolutely gone; and he was leaving the works with that conviction. It, however, came about that the Deputy-Chairman of the Gas Committee had, in the meantime, arrived; and a further test of the gas was applied, which showed it to be of 16·8-candle power, and not 15·6, as appeared by the previous test. My comments on these tests are: (*a*) That the enriched gas in the holder had been stored for a *fortnight*, and that it was utterly unreasonable to expect that it would retain its enrichment to the full for so long a period. I expressed this view in a telegram which I sent to Mr. Wood, from King's Cross, on the evening before the tests were made. It was as follows: "I strongly protest against testing gas stored for two weeks, especially not having stored for same period coal gas enriched by cannel. Nobody produces gas to store same for fortnight. Twelve or twenty-four hours quite sufficient practical proof permanency. Wait with test till I return. Show telegram Chairman. Wire result." Following up my suggestion, the test of permanency was subsequently applied to gas enriched with cannel coal, with the result that such gas, stored for three weeks, was found to have deteriorated to the extent of *three* candles—namely, from 17-candle power to 14. A record of this appears in the books at the Corporation gas-works. (*b*) But even under the severe test which Mr. Dixon applied, his statement that the enrichment had absolutely gone is inaccurate. It is well known to gas makers that, on an occasion of making tests, the gas first drawn off shows worse results than that which is taken later; and the result of the later test reported by Mr. Dixon shows that the gas in the holder was still, after a fortnight, fully a candle better than gas made from ordinary coal.

2. Mr. Dixon's statement as to the quantity of gas obtained by my process from a ton of oil is altogether opposed to the results as shown by the books at the gas-works. Mr. Dixon says that at one time 8964 cubic feet of gas were obtained by my process at the Thornton Road works from a ton of oil; and subsequently 11,738 feet were so obtained. I adhere to my own statement that not less than 17,000 feet have been always obtained there from one ton of oil, and when the quantity of bye-products has not exceeded 8 cwt.—that is, 40 per cent.; and I challenge a full examination into the accuracy of this statement. Mr. Dixon stated that between the 19th of November and the 8th of December 14 tons of oil had been consumed, and that the average make of oil gas per day was 6317 cubic feet. I allege—and the books at the gas-works clearly show—that only 10 tons of oil had been consumed between these dates; and, further, that my apparatus there has produced 1134 cubic feet of gas per hour, equal to 27,216 feet in twenty-four hours.

3. Mr. Dixon also stated that the gas which he saw tested had been enriched with bye-products, and that the value of the bye-products had been over-estimated. In both these particulars, he is again in error. The gas which he saw tested had not been enriched with bye-products, but with oil gas; but the books at the gas-works show that 11½ million cubic feet of gas have been there enriched by such bye-products. Mr. Dixon, after referring to the supposed unsatisfactory result of the tests made on the 5th of December, said: "In order to fortify himself on this point, he obtained a bottle from the office, and took some of the residuals, and sent them to be analyzed. The result was to bear out the test which he had seen made." I should like to know whether he is prepared to justify the above as a candid statement of facts in two particulars. First, had he not taken the sample of residuals some time before testing the gas, and did he obtain his analysis from an independent and disinterested source? I have had an analysis of my residuals tested by independent chemists of the highest reputation; and the result I am prepared to place beside the analysis obtained by Mr. Dixon.

I have now shortly dealt with the various objections which Mr. Dixon has raised to my process, and will conclude with only two observations. The first is that Mr. Dixon at the meeting of the Council on the 10th of July last advocated the acceptance of the offer of the Northern Counties Hydro-Oxygen Gas Company (usually known as the Huddersfield Company), the application of which to *one-third* of the Corporation's total year's make of gas would, according to the report of the Corporation Gas Engineer, dated the 2nd of July last, cost the Corporation £3358 per annum; while the offer which I and those who are associated with me made was, and still is, to allow the Corporation to use our process to any extent they please, absolutely without charge. My next observation is that Mr. Dixon seems easily and in a few visits to have come to a conclusion as to the unsuitability of my process, although he in his speech speaks of the Corporation Gas Engineer as not having had time to fairly settle the question in his own mind.

Surely the course which Mr. Councillor Crossland advocates is the wise one—viz., that the Engineer should be asked to present a report on the whole matter; and I would add that, if he should not be able satisfactorily to settle all the questions which the Chairman of the Gas Committee has raised, there are surely experts in gas engineering and chemistry who could be called in, and who might help the Council to decide whether they would gain more by paying several thousands a year to the Huddersfield Company or by adopting gratuitously the system of your obedient servant.

THE IMPROVEMENTS AT THE BOLTON GAS-WORKS.

The Corporation of Bolton are carrying out a series of important improvements at their Lum Street Gas-Works; and it is also proposed by the Gas Committee to follow this up with extensive alterations at the Gas Street works, briefly referred to in the JOURNAL for the 1st inst. At Lum Street, the original engine-house has been completely renovated; the dimensions of the interior being about 42 feet by 24 feet, and 16 feet high. There are two new engines and rotary exhausters combined, each capable of passing 150,000 cubic feet of gas per hour. Another important addition recently made to these works consists of two new station meters, which will pass 100,000 cubic feet of gas per hour—60,000 cubic feet more than the old ones were capable of dealing with in the same time. The new meters are provided with 24-inch diameter inlet and outlet valves, and with suitable bye-passes. The foundations are down for a commodious meter-house to enclose them; and an overhead railway is being constructed to connect the retort-house directly with the Corporation sidings; thus allowing coal to be brought for distribution at various points in the retort-house at much less cost than at present. Besides minimizing labour, this elevated railway arrangement will secure a larger quantity of coal storage, and thus help to meet more effectually the winter demand for gas. When completed, the railway will be 220 yards long, and by its agency thirty waggons of coal can be brought in at one time; while, by the existing arrangements, eight or nine waggons are the most that can be dealt with. A new governor has been provided, having 24-inch connections. Plans have been prepared for an intended rebuilding of the present retort-house on a large scale, to meet the increasing requirements; and at the Gas Street works, the improvements proposed include the taking down of the present retort-bench, and the erection of a new bench on the generator principle, similar to the one put up at the Lum Street works some three years ago. The bench now in use at Gas Street contains 252 retorts; but the new one will have 288 retorts, which will be sufficient to carbonize 200 tons of coal in 24 hours—this being 49 tons more than can be dealt with by the existing retorts there. The estimated cost of this transformation, together with certain needful accessories, is about £7200, which will be reduced to about £5160 by the sale of the old material. It is also contemplated to extend the purifying apparatus at the Gas Street works by the erection of two additional purifiers, each 22 feet square, and to put up a new condenser. Mr. W. Smith, the Corporation Gas Engineer, says that, "judging from the results achieved by similar improvements at the Lum Street works (where in two years all the cost has been recouped to the Corporation by increased and cheaper production of gas and residual products), the advantages which will accrue to the town by the adaptation of the Gas Street works to the extent outlined will be very great indeed." All the plans and other architectural work connected with the alterations have been prepared at the Lum Street works by the Gas Department officials under Mr. Smith. At the recent monthly meeting of the Town Council, Alderman Miles, replying to a query about the extensions and improvements at the gas-works (estimated to cost £20,000 altogether), gave a brief outline of what was contemplated. He added that, in his opinion, the Gas Committee had done wisely and well; their experience at Lum Street having been so successful, and productive of such excellent results.

ELECTRIC LIGHTING NOTES.

There was a vigorous debate in the Liverpool City Council last Wednesday upon the important proposal of the Special Lighting Committee that the Council should offer to purchase the whole undertaking and business of the Liverpool Electric Supply Company, as a going concern, during the present year (instead of waiting until the period arrives when the Corporation could compel the Company to sell), at such price and on such other terms and conditions as may be agreed upon, or, failing agreement, as may be settled by arbitration. In view of this meeting, the Deputy Town Clerk (Mr. H. E. Clare) had prepared, in accordance with instructions, an exhaustive report dealing with the question. In this he traced the action of the Corporation in regard to electric lighting since they first considered the subject in 1878. In the following year, they obtained authority from Parliament to carry out experiments for five years; but the powers were not carried into effect. In 1888 the Electric Supply Company, with the consent of the Corporation, obtained authority to put down an installation; and from time to time since then their powers have been extended. From the report, it appeared that the position of the Corporation, under the various Provisional Orders, was shortly this: At the expiration of 42 years from July 3, 1891, the Corporation, on giving six months' notice, could purchase the undertaking at its then market value, without paying any compensation for compulsory purchase, goodwill, or loss of profits; due regard, however, being had to any loss occasioned by severance. Under the Company's Order of 1892, if the extension of the city boundaries was not carried out, the Corporation had power on June 30, 1898, or on any subsequent June 30, on giving not less than twelve nor more than eighteen months' notice before that date, to purchase the portion of the undertaking within the city as a going concern, at a price to be agreed upon, or, failing agreement, to be settled by arbitration; but the purchase-money was to include compensation for any loss occasioned by the severance of the portion of the undertaking in Toxteth Park from the remainder. If, however, the extension of the city boundaries was carried out, the Corporation could purchase the whole of the undertaking within the extended city on June 30, 1900, or at any subsequent June 30 (on giving notice as in the last preceding case), as a going concern, at a price to be agreed upon, or, failing agreement, to be settled by arbitration. At the meeting of the Council, Alderman F. Smith moved a resolution, of which the substance is given in the opening sentences of this paragraph, and which, in addition, authorized the Committee "to take all steps, and to do whatever may be necessary to carry out the object of the resolution." In its support, he said it was the duty of the Corporation to supply the very best light on the very best terms to the people living within the boundaries of their government. They had had one experience of a monopoly; and it was not such as to make them desire a repetition. In the course of his arguments, he pointed out that the Corporation were the road authority, and ought to keep their powers as far as possible under their own control; that instead of making a profit for shareholders, the object of the Corporation would be to do the best possible for the convenience of the public; and that they would be in a better position for giving facilities to the public. Referring to electricity as a motive power, he said he understood electric energy was now supplied by the London Companies at 3d. per Board of Trade unit—a price which, he believed, was very much cheaper than running gas-engines, and many of the forms of energy. There were several purposes for which the Corporation required motive power; and there were also many streets of the city where the electric light could be substituted for gas. The speaker quoted figures showing the progress of the Company, from which it appeared that, on the 1st inst., the lamps connected with the system numbered 31,000. Passing to the financial aspect of the question, he said the Corporation were able to borrow money at about 2½ per cent.; and they were certain to save the £8000 that had been effected by the Corporation taking over from the Gas Company the lighting, lowering, and extinguishing of the public lamps, and which would go a long way towards providing interest and sinking fund for any amount they would be at all likely to pay to the Electric Supply Company for their undertaking. He was informed that £250,000 had been expended by the Company in providing the plant for the work they were doing and had in contemplation. Therefore it was impossible that the Council could acquire the undertaking for a less price than that. The gross profit was £15,498; and the Company paid in dividends £8589. The resolution was seconded, after which the Right Hon. A. B. Forwood opposed it. In a long speech abounding with figures, he said that unfortunately a sort of electrical octopus had its grasp on the Municipality; and it was to be regretted that they had got into that position. In considering the price which would have to be paid for the undertaking, he took the profit of the Company for 1893 at £15,400. To produce this income for the present owners of the undertaking would require a payment of Corporation stock—taking it at 3 per cent., and at about 33 years' purchase—of something approaching £500,000. It was idle to suggest that the proprietors would take par value for the concern; the value which the Stock Exchange set upon the £5 shares being about £7 10s. The right hon. gentleman also quoted figures which went to show that, if the Corporation acquired the works, the annual charges would amount to close upon £30,000; whereas the income last year came to less than £16,000. He did not see why the £8000 which had been saved in the public lighting should be sacrificed for the benefit of the electric light users. The attitude he preferred to take in this matter was that, when the Company again asked for further powers, the Corporation should insist upon the same conditions being imposed upon them as had been applied in the case of the Gas Company—viz., that all new stock should be sold by auction or tender, and the users of electricity have the advantage of whatever premium was obtained. In conclusion, he moved an amendment to the effect that the Council did not think it desirable to at present purchase the undertaking, and instructed the Lighting Committee to endeavour to secure to the public, in any future Provisional Orders, less onerous conditions in regard to the cost of lighting, and to the Corporation the option of purchasing at an earlier date than 42 years. The amendment was seconded. Among the subsequent speakers was Mr. Ripley, who did not see why the Corporation should enter into negotiations with the Company, seeing that, by utilizing the Vyrnwy compensation water, there would be quite sufficient power to make electric light for the whole of the city. Two or three other members protested against a small Committee having such powers conferred upon them as were suggested by the resolution. On the amendment being put to the vote, only 6 members declared in favour of it, and 36 against. Other amendments were likewise rejected; and ultimately the recommendation of the Committee was carried by 29 votes to 13. The Council also empowered the Committee to ascertain the cost, and to formulate the details, of a scheme of supplying all the public buildings and markets in the city with electric light from a general station to be established by the Corporation, and to obtain estimates from the Electric Supply Company for the work. It was stated by Alderman Smith that the buildings which it was proposed to light were all within a radius of half a mile; and at the present time the Corporation pay nearly £4000 a year to light them with gas.

Judging by reports which reach us from time to time, the inhabitants of Hastings and St. Leonards must now heartily regret the change that has been made in the system of lighting their magnificent seafront. Only last Wednesday, a writer in a local paper thus expressed himself on the subject: "Complaints are beginning to be made respecting the unsatisfactory manner in which the Electric Lighting Company are carrying out their contract for the lighting of the Front line. We can only express our surprise that such complaints have been so long delayed, considering the grounds which have existed for several months past. At meeting after meeting of the Public Lighting Committee, batches of reports from the police are handed in bearing on this very question; and when communicated with, the Directors of the Company promise a remedy, which certainly has not yet been effected. The 'Whitehall' lamps of the Gas Company used to give a sufficiently powerful, a steady, and a thoroughly reliable light; whereas now it sometimes happens that every alternate electric lamp is out, and some of the others are as erratic in their movements as a vicious mule. The whole thing is, indeed, as unsatisfactory as it can well be; and since it is admitted that our Front line ought to be particularly well illuminated—an argument which was made a great deal of by the advocates of electric lighting—the Lighting Committee ought to take some definite action forthwith to obtain satisfaction from the Electric Light Company, or put an end to the contract, which, by-the-bye, ought never to have been entered into until the Committee had satisfied themselves that the Company were in a position to adhere to its provisions."

Some up-to-date information regarding the electric lighting works of the Halifax Corporation has been published. The undertaking is completed so far as it is proposed to go at present; and the cost to this stage has been £33,000. The site on which the works stand measures 5000 square yards; and only about half of it is as yet occupied. The high-pressure alternating current system has been adopted. The principal apparatus consists of three Lancashire boilers, 30 ft. by 7 ft. 6 in., fitted with mechanical stokers; a Green's economizer for heating the boiler feed water; two compound horizontal condensing engines of 200 indicated horse power each, and one of 100-horse power; two compound horizontal non-condensing engines of 20-horse power; and two alternating dynamos of 100 units each, and one of 50 units. The current is generated at the high pressure of 2000 volts, and is carried by high-pressure mains to the centre of the town, where it is transformed before entering the premises to be lighted. The charge for the current is 6d. per Board of Trade unit. The supply was only commenced on the 1st ult.; and already 2000 lamps have been connected, and 1000 more have been ordered. Those in authority feel sanguine that the works will yield a profit in twelve or eighteen months.

At the meeting of the Commissioners of Sewers of the City of London on Tuesday last, Mr. Johnson asked if the Streets Committee had considered the question of possible reduction in the cost of the public lighting of the streets. Mr. Burmester replied that certain experiments were being made with a system differing from the arc lighting; and it was hoped they might turn out successful, and prove better than the present arrangement. Mr. Johnson asked if it was true that there would be a probable reduction of £1000 or £2000 a year. Mr. Burmester replied that he did not know whether or not this would be so.

THE EXPLOSIONS IN THE EUSTON ROAD.

Board of Trade Inquiry.

At the St. Pancras Vestry Hall last Thursday, Major CARDEW, R.E., held an official inquiry, on behalf of the Board of Trade, into the circumstances attending the explosions which occurred shortly after midnight on the 29th ult., on the south side of the Euston Road, between Gower Street and Endsleigh Gardens (see *ante*, p. 37).

Professor H. ROBINSON, the Consulting Engineer of the St. Pancras Vestry, attended on their behalf; Mr. A. BASSETT HOPKINS and Mr. T. P. GUNYON represented the London County Council; Mr. G. F. L. FOULGER, Distributing Engineer of The Gaslight and Coke Company, watched the proceedings for them; and Inspector REED represented the police authorities. The following officials of the Vestry were also present: The Chairman of the Electricity Committee (Mr. A. Sweet), the Vestry Clerk (Mr. C. H. F. Barrett), the Borough Engineer (Mr. W. N. Blair, Assoc.M.Inst.C.E.), the Engineer and Manager of the electric lighting installation (Mr. J. T. Baron), the Chief Clerk of the Electricity Department (Mr. A. Pycroft).

The inquiry having been opened,

Police-constable *John Tiplose* deposed that, shortly after midnight on the 29th of December, he was on duty at the corner of Gower Place, when he heard an explosion in the direction of the Euston Road. Immediately afterwards, he heard a second explosion, and saw a number of flag stones fly into the air. There was no flame; but there was thick smoke, and also a smell of coal gas. About 20 yards farther on, he saw the top of a manhole, which had been blown about 8 feet away from the opening. As soon as he heard the second explosion, he went and informed the Gas Company and the electric lighting officials of what had occurred. He saw two men—one named Charles

Govier, and the other David Petrie—who were covered with mud. They said they had been knocked down by the explosion; and they were taken to University College Hospital.

Charles Govier, a farrier, of No. 183, Drummond Street, Euston Road, stated that, on the night in question, he was proceeding along the Euston Road with his friend, David Petrie; and, just as they were about to part, witness saw a flash, and he was thrown on to his back. He struggled up, and directly afterwards there was an upheaval of the pavement.

Mr. *A. Pycroft* reported that he visited the hospital the following morning, and was informed that Govier had a bruised side and Petrie a sprained ankle, but that both the cases were mild.

Mr. *J. T. Baron* stated that he had entire management of the whole of the electric lighting works. The manholes throughout the district were systematically examined every four to six days; and the two in question were last inspected on the day before the explosion. It was simply by smell that any escape of coal gas was detected.

By Professor ROBINSON: The presence of gas in the culverts had been a source of trouble for some time past; and on this account inspection had been more frequent. On Dec. 14 last, a letter was sent to the Gas Company complaining of an escape of gas in one of the manholes; and the Company had several places in the vicinity of the manhole opened on the same day. The scene of the explosions was visited by witness on Dec. 30; and it was discovered that the insulators had been displaced, although the supply of current was still good. There was no sign of the explosion in the cast-iron 8-inch pipe between the two manholes, though it was probable that the two reports heard were connected by that means. The brickwork in one of the manholes was much shaken by the explosion; and the cover and flooring were broken. In the other case, the manhole had been carried away; and the structure was considerably disturbed. With one of the Gas Company's inspectors, witness had since visited the manholes; and on some of the insulators was found an incrustation of caustic soda. Whenever this was discovered, it was removed; and for this purpose a thorough inspection was being made of all the manholes in St. Pancras.

By Major CARDEW: There was an explosion in Endsleigh Gardens in January, 1894; and the Board of Trade sent a letter to the Vestry on March 9, which contained several suggestions as to frequent inspection, proper ventilation, wooden shields under the covers, &c. These, as far as practicable, the Vestry had carried out. But it was found that any diminution in the size of the manholes, as proposed, would have been unwise; and this had therefore not been done. Since 1890 there had been several minor explosions in St. Pancras, all of which he attributed to the presence of coal gas; this being, in his opinion, the most reasonable scientific inference to be drawn from the circumstances surrounding the occurrences.

By Mr. BASSETT HOPKINS: He did not know that this kind of explosion had been of more frequent occurrence in St. Pancras than in other parts of the Metropolis.

Mr. HOPKINS: Have you any reason to offer for these explosions?

Witness: Well, it appears that there was coal gas in the manholes; and we do not deny that there may have been a spark.

By Mr. FOULGER: Four men were employed to go round to see if there were escapes of gas or water in connection with the electricity service. Gas-detecting instruments were not used on their system.

Mr. FOULGER: Are your copper mains tight?

Witness: I think so.

Is it not a fact that they are loosely laid on the insulators, and could be drawn so as to touch one another?—I cannot say that.

Would it be possible for decomposition to form hydrogen gas?—No doubt.

How much gas would be required to bring about an explosion?—I should not like to say.

Have you noticed in any of the boxes the presence of coal gas since the explosion?—Yes.

Have you made this known to our officials?—Yes; with no result.

Do you know there is always a smell from a gas-main, though there may not necessarily be an escape of gas?—The smell is our only test.

If the alterations made on your mains since the explosion had been originally carried out, do you take it that the explosion would not have occurred?—I do not say that.

Did you not say you were to make arrangements which would avoid such explosions?—Only as regards lower insulation.

Are you aware that the Gas Company's officials have been testing daily since the explosion, have been over the whole neighbourhood, and have not found the slightest trace of gas?—No; I am not aware of that.

Major CARDEW: You say you do not use gas-detectors. There are two or three patent ones. Have you seen them?

Witness: I have only seen two. I do not think either of them would answer our purpose.

Do you think there would be less danger of these explosions if you had the cable system instead of bare conductors?—That opens a large question.

Do you think that incrustations on the negatives may have had something to do with the explosion?—It might. We attribute it to an accumulation of coal gas.

Mr. *W. J. Thomas*, the outdoor inspector of the electricity department of the Vestry, stated that, at seven o'clock on the morning after the explosion, he went to a manhole about 43 yards west of the exploded manhole, and detected a strong escape of coal gas. Mr. Gunyon, of the London County Council, who was with him, also remarked upon the smell of gas. Witness considered the gas-detectors used by the Gas Company to be practically useless, as he had found the instruments fail on several occasions.

Mr. FOULGER: Could you tell the difference between gas in the main and gas in the culvert?

Witness: The two are not connected in our system.

Is it not the fact that if you have an india-rubber tube carrying gas in a house you have a gaseous smell, although there may be no coal gas present in the room?—That may be so.

If the water does not leak in through your ventilators, where would it come from?—From the brickwork. The bottoms of the manholes in question are of concrete, which would not be gas-tight.

Is it not a fact that you are bound, under your Provisional Order, to construct your culverts gas-tight?—I do not know that that is so.

Major CARDEW: I do not think that is quite the case. The words are: "Sufficiently protected against the accumulation of gas." I take it that you have to endeavour to prevent the gas from getting in, and, if it does get in, to get rid of it as soon as you can.

Mr. *W. N. Blair*, in answer to Professor ROBINSON, said that, after the occurrence, he made an examination at the point of the sewer nearest to that of the explosion—about 235 feet away horizontally—and found no smell of coal gas. Sewer gas was not, *per se*, explosive. He had known an explosion in a sewer that was traceable to coal gas. One could easily distinguish between the two gases. There was in this case a connection between the electric conduit and the sewer. As to the question of sewer gas being explosive, he could only say naked lights were constantly used in the sewers without producing an explosion.

Mr. FOULGER: Is it not the fact that refuse from an india-rubber factory, in conjunction with sewer gas, would, on mixing with a certain proportion of the atmosphere, become explosive?

Witness: I cannot say it would.

Major CARDEW asked Mr. Foulger if he would like to make any statement as representing the Gas Company.

Mr. FOULGER remarked that the Company denied, in this particular instance, that the explosion was, or could have been, caused by the presence of coal gas, because the whole of the tests they had applied had singularly failed to note its existence anywhere near the culvert. His presence at the inquiry was out of respect to the Board of Trade, and not because the Company admitted any liability whatever with regard to the explosion. He acknowledged that the explosion in Endsleigh Gardens in January, 1894, was caused by coal gas, because a leakage was subsequently found in one of their pipes. As far as his own knowledge went, however, the Company's officials failed to find any escape when they acted upon the letter received on Dec. 14 last. He went to the scene of the recent explosions; and there was then not the slightest smell of coal gas.

By Professor ROBINSON: He estimated that any leakage of gas in the roads, &c., would not amount to more than 1¼ per cent. Any increase in winter would be very small. Traction-engines sometimes fractured the Company's services—in fact, they looked upon them as their natural enemies. His theory with regard to the present explosions was that hydrogen gas had been generated by the dampness in the culvert, and that this was fired by what was known as "sparking."

Professor ROBINSON said he had advised the Vestry to supplement their present system of ventilation, so as to make it more thorough. The matter would be considered by the Electric Lighting Committee of the Vestry, who would report upon the subject. This report would be considered by the Vestry; and whatever might be deemed right in the public interest would be done.

Major CARDEW: Do you think that, by what you have already done, all danger of further explosion has been removed?

Professor ROBINSON: I believe so. It will prevent accumulation of gas, so far as the Vestry can do it. We cannot answer for the Gas Company remedying defects in their mains; but I will undertake that the Vestry will do their part.

Major CARDEW: The condition of things was known a year ago.

Professor ROBINSON: The suggestions of the Board of Trade have been carried out.

Major CARDEW: Partly.

The inquiry then closed.

THE COAL-MINING INDUSTRY OF GREAT BRITAIN IN 1894.

The following article on the above subject appeared in *The Times* last Tuesday:—

Year by year the general public finds it necessary to take a more direct interest in the course of the coal industry, the movements of which come home to them as domestic consumers, as manufacturers, as freighters, as shippers, and in a number of other ways. The somewhat musty problem: "Is life worth living?" has recently been solved for large bodies of both men and women by the reply: "It depends upon the coal miners." If coal is cheap and plentiful, many industries can be carried on steadily and profitably that would find it difficult to live if coal were dear, and could not be carried on at all if it were both scarce and costly. These considerations are likely to be present to the minds of many people who have been seriously prejudiced by the uncertain movements of coal miners, and by the great strikes of the last three years in the chief coal-mining centres.

Perhaps the most important event of the year 1894 in the coal industry of Great Britain was the strike of Scotch miners, which began about the end of July, and lasted for just 15 weeks. The miners evidently depended on receiving a much greater amount of assistance from other districts, and especially from the Midlands. The miners in other districts did not seem to have much heart in enabling the Scotch miners to continue their resistance after the tax laid upon them in consequence of the great Durham strike of 1892, and the still greater strike in the Midlands in the following year. The first of these was, as is generally known, terminated in what may be called a "draw." A reduction of wages was obtained, but not to the extent that was originally sought. The Midland strike of 1893 was generally regarded as a victory for the men, inasmuch as it ended without any immediate reduction of wages; and the miners in Scotland appeared to think that they could repeat the experience of their Midland fellows in 1893. In this, however, they proved to be mistaken. The Scotch coal is quite as difficult to get as that of Yorkshire; but it does not realize so high a price, being generally of an inferior quality. So much is this the case, that in metallurgical operations it requires several hundredweight more of Scotch coal to accomplish the same result; and hence the official returns show the average price of the coal produced in Scotland in 1893 to have been only 5s. 9d. per ton at the collieries, as compared with an average of 7s. 2d. for East and West Yorkshire, and about 7s. 10d. in North and East Lancashire. The natural consequence has been that the average rate of wages paid to miners in Scotland has invariably been under the rate paid in most of

the great English coal-fields. The Scotch miners, no doubt, made up their minds, when they entered into the struggle of last summer and autumn, that the time had come when this disparity as against their labour should cease; but no amount of striking or endurance could alter the fact that they produced an inferior article, which could not afford the same high rate of wages that was paid in Yorkshire, Durham, and other English districts. The men made a stubborn and almost heroic resistance. The contest was remarkable for its "dourness" and silent resolution, unmarred by any intimidation or violence worth speaking of; but its ultimate conclusion was inevitable. The men had to succumb; and the pits were gradually reopened on the owners' terms.

It is difficult as yet to say what effect the Scotch coal strike may have had on the coal output of the year. The strike was pretty general, on the whole; but some collieries were working all the time, and a good many others had resumed operations before the strike finally broke down. If we take the output of coal in 1893 as a standard, we shall find that the average weekly output of coal in Scotland as a whole was about half a million tons; and as the strike lasted for about 15 weeks, this would mean a reduced output of about 7½ million tons. But it is quite possible that the actual reduction may be much less than this, owing to the considerations already stated. In magnitude of results, the Scotch strike does not, of course, stand on anything like the level of the Midland strike of 1893, which is understood to have been responsible for a total decreased production approaching 17 million tons. But it certainly is not far behind the almost equally stubborn and protracted strike of Durham miners in 1892; and the three strikes together have meant a diminished output of coal to the extent of something like 32 million tons. This, at the average price of 1893, which may be taken as a medium, would mean a direct loss in coal output, as such, of £11,250,000.

One of the *memorabilia* of the coal industry during the past year is the fact that the United States have practically overtaken the United Kingdom as a coal-producing country, and may, in the present year, be a good deal ahead of us. When one considers the history of the coal industry in the two countries, this must seem a remarkable result to have achieved. In 1870, the United States produced only one-third of the coal output of this country; in 1881, the United States produced about one-half of the quantity of coal produced here; and now the two countries have practically come abreast of each other. The advance of the United States would almost certainly have been much greater than it has been had it not happened that petroleum and natural gas came very largely to take the place of coal in American markets. But now that the natural gas supplies have become partly exhausted, the development of the coal resources of the country is likely to proceed at an accelerated pace when the next industrial "boom" takes place.

Another very remarkable feature of the recent course of the coal industry is furnished by an examination of the run of prices. Within the last few years, the increased depth of working necessitated by the economic conditions under which the coal is won, the restrictions and the increased outlay entailed by the provisions of the several Mines Regulations Acts, and the movements of labour, with a few minor influences, have considerably increased the cost of producing coal in the United Kingdom. On the other hand, the greater command of capital, which has enabled collieries to be opened out and operated on a much larger scale, and the most economical machinery and appliances to be employed, the greater efficiency of labour, and the adoption of more economical methods and processes, have enabled other coal-yielding countries to produce considerably cheaper than they formerly did. The irrevocable result has been that Great Britain has now—and only within the last few years—ceased to command the supremacy which she formerly enjoyed as a cheap coal-producing country. The "Mining Statistics"—our official record of production and prices—show that the average value of the coal output of the United Kingdom in 1892 was 7s. 3d., and in the next year 6s. 9½d. per ton; whereas a few years ago it seldom exceeded 5s. to 5s. 3d. per ton. In Germany, the average value of the coal output, taken as a whole, was within a fraction of the same prices for the same years; while in Belgium, the average was somewhat higher, though in both cases the average was much below that of a few years ago. But in the United States, the recorded value of the output of bituminous coal has not for several years past averaged much more than 4s. 3d. per ton; and in some States, the average falls to about 3s. 6d. per ton, which is only a trifle more than one-half of the official value of our own coal supply two years ago.

Apart from the matter of strikes for a higher or against a lower rate of wages, the coal industry was greatly exercised during the past year by the demand for a compulsory eight-hour day in all coal mines. The subject of this demand led to a great deal of discussion both in and out of Parliament. To begin with, the demand appeared to be almost ridiculous on the face of it, in view of the fact, ascertained and published as a parliamentary paper, that in hardly a single district in the United Kingdom are the underground men now employed for eight hours a day. But it was ultimately explained that the authors of this demand did not mean eight hours of actual work in the mine, but a day of eight hours from bank to bank, which in a large number of cases would only mean six or six-and-a-half hours of actual work "at the face." The coalowners were naturally very much alarmed at a proposal which, if carried out, would have tended to reduce the hours during which coal could be drawn to the surface from nine to seven hours a day, or perhaps even less than that; and they made vigorous efforts to induce the Government to either have the Bill withdrawn or greatly modified. On an amendment, proposing that the adoption of an eight-hour day should be left a matter of local option, the promoters were defeated, and the Bill was withdrawn; but it is understood that it will reappear in the ensuing session. In view of this fact, an experiment made during the past summer by Mr. Emerson Bainbridge, who is interested in coal mines in South and West Yorkshire, which employ upwards of 15,000 men, has a very material importance. Mr. Bainbridge decided to test the effect on production and cost of the proposed eight-hour day by working at three of his collieries exactly the same number of hours that such collieries would require to work if the Bill had become law. He found that, so tested, the Bill would have been likely to cause a reduction of 22 to 32 per cent. as the result of the shortened day, and that the increase in the cost of production due to the same cause would vary from 4d. to 1s. per ton; while, if the day's wages were left unaltered, the additional cost would vary from 10d. to 2s. 5d. per ton. This test is confirmed by another made some time previously by Mr. D. Thomas, M.P., and continued for 13 months, proving that there was a difference of 23 per cent. in the output. Now, if we take the difference at the last-named figure, it would mean that the adoption of the eight-hour day in coal mines generally would involve a reduction of output to the extent of about 40 million tons a year; and, if we take the average annual output at 300 tons per employee (though, under the eight-hour day, it would be considerably less), it would involve the employment of about 136,000 more men in and about the pits. It may be supposed that this would not be a bad thing for the community, inasmuch as it would find work for a large number of unemployed; but, even so, the result would be totally incommensurate with the mischief that would be caused by the coal famine which would almost inevitably ensue on the passing of such a Bill. It would not be possible to avoid such a famine by drafting large numbers of men at once into the pits, for one of the provisions of the last Coal Mines Act prohibits the employment of men "at the face," unless they have had a year's previous experience in working coal, or are under the control of one who has had such previous experience; so that, although the operation of mining coal is not one that involves a very high degree of skill, men competent to perform such work could not all at once be multiplied indefinitely. It is to be hoped that these facts and considerations will have due weight when the question is again before Parliament.

Owing partly to the decreased price of coal, to the still exceptionally high labour cost of working, and to the irregularity with which a large number of collieries have been operated, the coal industry was probably less profitable during 1894 than it was—apart from special losses due to strikes—in the three previous years. In practically all the leading coal-fields, the rate of wages paid to the men is still considerably higher than that paid previous to the last rise of prices, which set in about 1888; and as about 70 per cent. of the cost of getting coal consists in wages, this difference tells very sensibly on its ultimate value. The fixed charges involved in the raising of coal, in an average colliery in full work, have been estimated at rather more than 1s. per week; but if the colliery is only working half time, these fixed charges, which have not much elasticity, and remain fairly constant, have to be borne by half of the regular output, and consequently rise to upwards of 2s. per ton. This was the experience of many firms during the past year; and in all such cases a lower selling price has come against an undiminished, and perhaps, in a good many cases, an increased cost of production. Returns collected by the Board of Trade show that more than 41 per cent. of the collieries that reported in November were only working between 10 and 20 days in the month; and the average of all the collieries in Great Britain, founded on the returns actually received, is given as only 4·80 days in that month.

Though reductions have been made in the rates of wages paid during the year in some of the leading districts, these have generally been settled amicably and without much friction. In the Midland coal-fields, the arbitration which followed upon the great strike of last year gave a smaller reduction of wages than the coalowners had hoped for; and the wages paid in that district continue to be exceptionally high. But it is hoped that any future variations in the rate to be paid may be settled satisfactorily through the machinery now provided for the purpose, as a result of the great strike of 1893. In South Wales and Monmouthshire, the rate of wages still paid is 21¼ per cent. above the standard of December, 1879. Some departments of the coal trade were particularly good during the past year, which has enabled coalowners to pay a better rate of wages than they could otherwise have done. There was an increase of 3,698,000 tons in the quantity of coal exported to the end of November; and the average export value returned for the eleven months was 10s. 6d., as compared with 9s. in 1893, and about 11s. 1d. in 1892. The demand for shipping coal was also good, and shows to the end of November an increase of upwards of a million tons on the previous year.

One important feature of the working of collieries during the past year was the very considerable extent to which electric power was applied to pumping, hauling, and lighting. Electricity has generally been adopted for these purposes at all the newer collieries; and it has yielded, on the whole, satisfactory results. It is claimed that electric power is more economical than any other; and in a good many cases, this claim has been confirmed by results.

Gas Affairs at Walsall.—On the *agenda* for yesterday's meeting of the Walsall Town Council were the following recommendations: That application be made to the Local Government Board for power to borrow, when necessary, a further sum of £50,000, for the purpose of the gas undertaking, the present borrowing powers of the Corporation being nearly exhausted; and that an independent gas-main from the Pleck Gas-Works to the Wolverhampton Street Gas-Works be laid, at an estimated cost of £792.

The Troubles of Gas Managers.—A good instance of the difficulty some gas managers have in pleasing "those who are put in authority over them" reaches us from Bangor. At the last meeting of the City Council, Mr. T. G. Williams called attention to the fact that the Gas Manager (Mr. J. Smith) had recently erected, at a cost of £6 10s., a small chimney, with the object of increasing the production of gas; and he stated that 1000 cubic feet of gas per ton of coal had thus been added to the ordinary production. Mr. Williams took credit to himself for having urged the adoption of the plan, which had now been carried out; and he remarked that when he did this he was accused of "venting his spleen" against the Gas Manager. But, though his wishes have been complied with, Mr. Williams is not satisfied. He said he thought the Manager was still to be blamed—in the first place, because he had erected the chimney without the sanction of the Council, and, secondly, in that he had not sooner adopted the plan now resorted to. Other members having spoken in a somewhat similar strain, Mr. R. Hughes deprecated discussion on a matter which could, he said, be much better dealt with in Committee; and he said it was not fair to the Manager to make attacks upon him in the Council.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

This has been a week of fog—more particularly in the west—so far as Scotland is concerned; a dense, black fog, which made it impossible in Glasgow to see an object three yards off, and which entirely put a stop to traffic on the Clyde for the greater part of a day. Such visitations are, in one sense, welcome to gas managers; but in other respects, they are very unwelcome. They greatly increase the consumption of gas, and thereby help the revenue; but they give a great amount of extra trouble and anxiety to the manager and his staff. That has been the experience this week in the Glasgow Corporation Gas-Works. Indeed, the works have been greatly taxed to meet the demand upon them during the past fortnight. The weather has been very severe—frost and snow constant, with gales occasionally; and as there are a very large number of gas-stoves in use in the city, shivering humanity has made extensive application to them for necessary warmth. This is a consumption which goes on both day and night; and the amount of it retarded greatly the efforts of the gas workers to get the holders up. When, in addition, on Wednesday and Thursday, there came the fog, leading to a general lighting up, it can be easily understood that the task of keeping the supply of gas equal to the demand was an onerous, and by no means a cheerful one. The community is easily made to grumble; and already a gentleman has written to a newspaper editor a letter in which he wants to know, in effect, why he cannot get the gas he pays for, at the time when he most wants it. The letter only appeared to-day, so there has been no time to reply to it. I do not expect, however, that there will be any reply, unless a statement be made at the next Town Council meeting; but there are likely to be a few more grumbles. It is rather curious, in connection with public grumbling, that there is a much greater readiness to throw the complaint broadcast than to appeal direct to the body whom the discontented regard as the offenders In this instance, no complaint of want of gas has, up till this fore noon, reached the gas office of the Glasgow Corporation; and the officials look upon it that the supply was practically equal to the demand. So it was; but Mr. Foulis and his staff know that, if they could have afforded to send it out, more gas would have been consumed, so that in this sense the supply was not equal to the demand. The number of consumers—particularly in the south side of the city—has so greatly increased of late years, that the Tradeston works, recently enlarged and fitted with the most perfect machinery, are unequal to supplying the quantity required. The Gas Committee are fully alive to this; and it is with satisfaction that the information comes that they propose to proceed at once with the erection of a large additional holder in connection with these works. The new holder is to be erected upon a site entering off St. Andrew's Road, a very short distance from the works. It is in the matter of storage accommodation that the Glasgow Corporation gas undertaking is weakest. In all other respects it is exceptionally strong; and the information that it is intended to strengthen the storage provision, is therefore welcome. There is, at present, no difficulty in the matter of coal supply, either as to quality or quantity—a circumstance which greatly lightens the labours of all at the works.

One curious effect of the fog was that it practically stopped business in the Glasgow corn market on Wednesday. The place was so dark that nothing could be done. There is no gas in the market; and the explanation is given that it would be of no use though it were, because merchants could not sample their goods by its light. This is a doctrine I am not prepared to accept. Even though gaslight may not be anything like equal to even dull daylight for the sampling of grain, surely any light is better than none.

How did the electric light fare in the fog? I do not know whether the Engineer in charge of the Glasgow Corporation Electric Lighting Department had any difficulty in keeping up the supply, but there were complaints regarding the want of light from it; and my information is that the lofty arc lamps in the streets were practically useless—you could just see that there was a light up in the air, but none of the rays from the lamps ever reached the ground, or made any perceptible difference upon the prevailing mirk.

The severe weather we have been experiencing is certain to be felt in connection with both gas and water supplies. The temperature has in some places been below zero, which is sure to produce, when the thaw comes, a crop of burst water-pipes, and in the meantime is certain to interfere with the working of wet gas-meters in exposed places. The village of Townhill, which is supplied from Dunfermline, is reported as having been without both gas and water on Thursday. In Perth, also, a good deal of inconvenience has been felt.

I cannot allow Falkirk to drop yet. While thankful for the large amount of good "copy" I have got out of the negotiations for the transfer, I look for some more before the Corporation get settled down in their management of the gas undertaking. On Monday of this week, the Corporation held their first meeting, to consider the award. It is significant of the way in which the Lighting Committee have conducted the business all through—and gives small ground for the expectation that they will bring an altogether suitable mind to the management of the undertaking—that they did not content themselves with reporting the conclusion of their labours to the Town Council, and taking the opinion of the Council upon the subject, but came forward as well, without any authority for the step, with recommendations as to the future management of the undertaking. Of course, this policy had the effect of turning the thoughts of the members to the future; and the past was neglected. Yet it was the past they should have dealt with first. There might, for instance, have been some explanation given of the reason for the great efforts which were made to maintain secrecy in all their proceedings, which was a useless endeavour, seeing that every step they took was known all over the town the day after it was taken; and what good had resulted from their hole-and-corner methods. Some explanation might also have been given of the reasons they had for objecting to Mr. Barr as Oversman. But above all, it might have been explained why they set about trying to acquire for less than £40,000 an undertaking which has cost them £76,000, or, if the costs be added, £85,000 at least. These points were scarcely referred to. There was a feeling of regret expressed that the price has been fixed so high; but then Mr. Storey, the Convener of the Lighting Committee, proceeded to say that they thought the transfer would pay the town very well. There was very little criticism of the actions of the Lighting Committee, though there was room for a good deal; and the Council acquiesced in the award, and proceeded to appoint Committees to manage the undertaking. Instructions were also given for the withdrawal of the action for the reduction of Mr. Barr's appointment, to save further expense. The Committees have set to work, one of them to negotiate a loan to meet the purchase price, and the other to make arrangements for the transfer on Feb. 2. The Gas Company have furnished the Council with the documents necessary for the preparation of the conveyance; and they have intimated that they have appointed Mr. A. MacPherson, of Kirkcaldy, to be their representative in the valuing of the stocks. They have also furnished information regarding the contracts which are running.

Regarding the award itself, the full text having been divulged (see *ante*, p. 129), it is found that the Arbitrators included in the amount of the award the valuation put by Mr. Black upon the house property owned by the Company. The amount was £1050. Deducting this sum, leaves the amount of £76,000 which is to be paid for the (strictly speaking) gas undertaking. While it is true, as stated in your leading article on the subject last Tuesday, that the award works out at a little less than 16 years of Mr. Lass's adjusted profit of £4848, it is scarcely to be assumed that the Arbitrators took the figure which was furnished by the witness for the Gas Company. It is quite evident, on the other hand, that they did not take the figures of the witnesses for the Corporation as to the amount of maintainable profit. Mr. Robertson and Mr. Brown fixed it at £2104; Mr. Linton, at £2142; and Mr. Hunt, at £2159. The average of these is £2127, which makes the price work out at more than 35½ years' purchase, or 12 years more than was asked by the Company. Not to knock the Company down to a 16 years' purchase, suppose the Arbitrators proceeded upon neither of the figures, but worked out the amount in this way: Taking Mr. Lass's figure of £4848, and deducting from it the £2127, there is left £2721, which, less £90 of rents of property, leaves £2631. If this sum is divided by two, and the product deducted from £4848, there would be left as a maintainable revenue £3533, which, at 21½ years' purchase, would work out at £75,959. That is very near the sum awarded; and it is just probable that in some such way the Arbitrators arrived at the amount they have given.

The North British Water-Gas Syndicate has gone out of existence. The shareholders held their final meeting in Glasgow on Monday, and received the report of Mr. A. Moore, C.A., the Liquidator, to the effect that he had, in obedience to the order of the Court, paid over to the Amalgamated Company the sum of £8000; that the shareholders of the North British Syndicate had received shares in the Amalgamated Company, but that, although no liability attaches to the shares, a number of them had not been taken up; and that, although the Directors were entitled to £12,500 of fees, they had agreed to take £2500. There were no other liabilities. This latter fact shows how altogether uncalled-for the Syndicate was, and how foolish the people were who put money into it, because it has practically done no business. One of the shareholders wanted to know if no recourse could be had against Mr. Samson Fox. The Liquidator, however, could give no information on this subject; and as there was no other business before the meeting except to receive his report, he closed the proceedings. The significant fact was mentioned by the Liquidator that there was no price for the shares. One cannot but feel astonished that the original promoters of water-gas business should be, so far as can be seen, doing nothing to earn revenue; while others, who came in after them, are pushing their business. If matters go on as they are doing, the existing capital will, reasoning from the example here given, be swallowed up in time in Directors' fees. I do not know the Articles of Association, either of the North British Syndicate or of the Amalgamated Company; but it looks strange that Directors' fees should be taken from capital, and not from earnings. Of course, there have been no earnings which could meet them; but then, in the same way, there are no earnings to pay dividend, and it looks as if it would have been as correct to have paid dividend as Directors' fees out of capital.

The Hamilton Corporation have, by reducing the price of gas from 2s. 11d. to 2s. 1d. per 1000 cubic feet, increased the consumption so much that it is now necessary to face an extension of the works. As compared with 1891, the maximum make of gas per 24 hours has increased by 50 per cent.; and the maximum consumption by 62 per cent. It will be remembered that, in 1891, it was proposed to expend a large sum upon the extension of the works, but that the Manager (Mr. James Ewing), by re-arrangement, enabled them to avoid that, and also to reduce the price of gas. He was able, by a regenerative arrangement, to increase the retort-power, without increasing the number of ovens, from 300,000 cubic feet to 750,000 cubic feet per 24 hours. The proposed extensions in 1891 were estimated to cost £20,000. By Mr. Ewing's arrangement, this was avoided; and the Corporation have, for 2½ years, saved the payment of interest upon this sum. It is now proposed to erect a new holder; the reason for which is that the maximum output of gas during December was 120 per cent. more than the storage capacity at the works. Further condensing and scrubbing plant and larger purifiers are also required. The cost will probably be £10,000 to £12,000. Mr. Ewing has been instructed to prepare plans and estimates. The working results for December show that, from 1149 tons of coal and shale, there was derived 11,706,200 cubic feet of gas. The returns for residual products were: Tar and liquor, £250; coke, £118; and spent lime, £15. Mr. Ewing is fortunate in having, as Convener of the Works Committee, Mr. W. Brown, who, in the face of considerable opposition of a not too intelligent nature, sticks manfully to the Manager, and does all he can to further his proposals and lighten his work.

Henry M'Intosh, a worker in the Cupar Gas-Works, was severely burned while at work last night. He was filling a barrel with tar from a tank; and on striking a match to see if the barrel was full, it is said an explosion took place, and the tar was ignited. He was obliged to run home, in flames, before he could get assistance. Others arrived on the scene, and extinguished the fire in the works.

Another, and a serious fatality has occurred in Glasgow by gas poisoning; a mother and her five children having been found dead from that cause this morning. The occurrence took place in the Springburn district, on the north side of the River Clyde. The family was that of a shoemaker; and the discovery was made by a fellow-workman, who went to the house to see why he had not gone to work. All the children were found to be dead. The father and mother were alive, but unconscious; and the mother died before assistance could be procured. The father was removed to the Royal Hospital.* A lamp was burning on the table, which may be taken to point to a very small escape of gas. The reports of the occurrence attribute it to an escape of sewer gas; but I incline to the opinion that it was coal gas which proved so deadly.

In the paragraph of our Correspondent's "Notes" last week referring to the make of gas in Dundee in November last, a falling off of nearly 2½ million cubic feet was shown, as compared with the corresponding month of 1893. We are asked by the Corporation Gas Engineer and Manager (Mr. John M'Crae) to state that the actual consumption of gas for the two months was as follows: November, 1893, 62,924,000 cubic feet; November, 1894, 64,771,500 cubic feet—or an increase of 1,847,500 cubic feet.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Jan.* 12.

Sulphate of Ammonia.—A better feeling is noticeable this week; and, on the whole, the market has a more encouraging appearance. Orders seem to have been freely booked in advance during the recent decline in prices; and to the necessity of filling these, the larger business is mainly due. But, at the same time, it is satisfactory to note that there have also been requirements from consumers direct. Several inquiries have been made for forward. But the small premium (about 5s. per ton) indicated for such delivery does not fit sellers' notions; and consequently nothing has been done. The business has been at £10 12s. 6d. to £10 15s.; and there are still buyers thereat. Nitrate on spot is slightly firmer, at 8s. 10½d. per cwt.

LONDON, *Jan.* 12.

Tar Products.—The business of the week has been conducted, generally speaking, at somewhat easier prices. This is especially the case with pitch, which for prompt delivery is no better than last week's quotation, and for forward is still easier. Benzols are more inquired for, both for January-June and January-December; but the prices offered are lower than have yet been accepted. Business has been done in carbolic at the increased prices mentioned; and there seems some likelihood of still further slight improvement. Cresylic acid is weak, and little in demand. Creosote does not realize, either for prompt or forward the prices recently obtainable. The values of the week may be taken as follows: Tar, 18s. to 22s. Pitch, prompt, 35s.; forward, 32s. Benzols, 90's and 50's, 1s. Solvent naphtha, 1s. 2½d. Toluol, 1s. 3d. Crude naphtha, 4⅜d. Creosote, liquid, 2d.; ordinary, 1¼d.; salts, 20s. Cresylic acid, white, 1s.; brown, 9d. Carbolic acid, 60's, nominal, 1s. 8d. Anthracene, "A," 1s. 1½d.; "B," 10½d.

Sulphate of Ammonia begins at last to show the improvement anticipated; and during the next few weeks, considerable advance is probable. Meantime the current price is several shillings a ton above the bottom. The price may be taken as £10 17s. 6d. to £11 2s. 6d., less 3½ per cent. Gas liquor is offered at 6s. 6d. to 8s. 6d.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—The increased demand for house-fire qualities, which has necessarily been brought forward by the severe weather of the last fortnight, gives a somewhat stronger tone to the market; and with pits having been stopped for a considerable time for the holidays, a good deal of stock has been filled up to meet requirements. There is, however, no really quotable change in prices, except that collieries are now holding firmly to what may be termed their list rates. Best Wigan Arley coals are not quoted under 10s. 6d. to 11s. per ton at the pit mouth; Pemberton four-feet and seconds Arley, 9s. 6d. to 10s.; and common house coals, 7s. 6d. to 8s. The lower qualities of round coal meet, however, with no appreciably increased inquiry for general manufacturing purposes; but the enlarged requirements for house-fire consumption necessarily tend to strengthen the position with regard to this class of fuel. The minimum price at the pit mouth is from 6s. 6d. to 7s. per ton. Engine fuel has been coming in rather more plentifully from outside districts, especially where there is no manufacturing outlet for the increased production of slack caused by the larger requirements for house coal; but these have not appreciably affected local quotations, which average about 3s. 6d. per ton for common, up to 4s. 9d. and 5s. 3d. for the better qualities. In the shipping trade, a moderate business is being put through; and steam coal, delivered at the ports on the Mersey, averages 8s. to 8s. 6d. per ton, according to quality.

Northern Coal Trade.—There has been, with the wintry weather, a considerable increase in the demand both for gas and household coals; but the manufacturing coal trade is dull—so many factories and shipyards being compulsorily idle. The demand for steam coal has also been reduced, so that the working of the collieries is very irregular. The Durham pits, however, have fuller time than of late. Best Northumbrian steam coals are now quoted 9s. per ton f.o.b., for prompt delivery; while second-class steam coals are sold at from 8s. 3d. per ton, though for forward delivery a higher price is named generally. Steam small coals are plentiful at from 3s. to 3s. 3d. per ton. Manufacturing coals are being sold, under contracts for this year, at about 6d. per ton less than those of the past year. Gas coals are now in very large demand, both for shipment and locally; but the deliveries are still adequate, as the pits are working fully again. Prices quoted still range from 7s. to 8s. per ton f.o.b.; and there is little likelihood of any early alteration of moment. Coke is steadied by the large demand of the local iron trade; but there is a slight improvement in the export demand. The price is unaltered, at from 13s. to 14s. per ton f.o.b. The production of gas coke is now very large; but the prices show no alteration this week.

Scotch Coal Trade.—The coal market in Scotland is very dull; and it looks as if a further reduction in prices would be necessary to enliven it. If this step should be resorted to, there is talk of a reduction of the miners' wages being imposed next month. The demand for shipping is the least satisfactory feature of the market; and it is felt that prices must come down before the trade which was lost during the strike of last summer can be got back again. There is little inquiry for any classes, except splint and dross; the latter of which is scarce. With regard to splint, it may be said that it is now selling at 9d. per ton below what it was last May, when the miners were advised to come out on strike, as the wage for getting it was too small. The prices quoted are: Main, 6s. 9d. to 7s. 3d. per ton f.o.b.; ell, 7s. 6d. to 7s. 9d.; splint, 7s. 3d. to 7s. 6d.; and steam, 8s. 3d. Shipments have not started the year well. For the week, they amounted to 69,987 tons—a decrease on the previous week of 58,347 tons, and as compared with the corresponding week of last year of 22,362 tons.

The Tiverton Corporation and the Gas-Works.—A proposal for the purchase of the local gas undertaking is to be laid before the Tiverton Town Council at an early date. It is understood that the matter has been under consideration by a Committee of the Corporation for some time; and it is suggested that the purchase price will be £20,000.

The Abatement of Smoke.—As the result of communications addressed to the Manchester and Salford Noxious Vapours Abatement Association, a conference was lately held at the offices of that Society to consider a proposal for the formation of a County League for the abatement of the smoke nuisance. It was explained that the objects of the League are: (1) To secure stricter administration of the law; (2) to secure uniformity of standards in determining nuisances; (3) to obtain more stringent legislation if necessary; (4) to render assistance to smoke producers by giving information as to the best known methods of smoke prevention; (5) to promote the more general use of gas for heating, cooking, &c.; and (6) to encourage effort for the solution of the problem of prevention of smoke caused by ordinary domestic coal fires. A resolution was passed in favour of the formation of a Lancashire Smoke Abatement League; and the meeting was adjourned in order to receive reports from the various districts represented by those who undertook to organize branches.

The Proposed Extensions at the Blackburn Gas-Works.—A Local Government Board inquiry was held at Blackburn last Thursday, by Major-General Crozier and Mr. A. E. Fletcher, respecting an application made by the Corporation for sanction to raise £12,000 for gas-works purposes. The Town Clerk stated that the money was required for the erection of plant for the production of carburetted water gas. It will be on the Merrifield-Westcott-Pearson system. Replying to the Inspector, he said the Town Council had borrowing powers for gas purposes to the amount of £150,000, none of which had been used. It was under these powers that the present application was made. The Corporation originally intended to spend £150,000 on new gas-works; but it had been decided to postpone this for a few years, principally owing to the large indebtedness of the borough. In the meantime, the Gas Committee had resolved to put up some water-gas plant, in addition to the electric lighting installation. The Gas Engineer and Manager (Mr. S. R. Ogden) and the Consulting Engineer (Mr. E. H. Stevenson) gave evidence as to the nature of the work proposed to be carried out; and the inquiry closed.

The "Little Don" Water Schemes.—The Law and Parliamentary Committee of the West Riding County Council last Wednesday submitted a report to that authority upon the Water Bills affecting the West Riding which are to be promoted in the ensuing session of Parliament. Dealing first with the Barnsley Corporation Water Bill, they stated that they found with satisfaction that the places within the proposed extended limits encompassed the whole of the proposed new works; and to this extent the Bill met with the chief requirements of their regulations as to water supplies. The fixing of the price to those places at 10d. per 1000 gallons, or any rate, was, however, looked upon by the Committee as objectionable; and they also raised objections to the clause in the Bill relating to compensation water, which was in direct opposition to the ideas of the Council, which required that the discharge should be continuous. The Committee were also of opinion that the clauses in the Bill referring to gauges for measuring the compensation water and as to right of inspection needed amendment. They pointed out that there was no provision in the Bill for penalties in case of neglect in discharging the prescribed quantity of compensation water, and said this should be added. The Committee also mentioned that they were taking steps to ensure that the volume of compensation water to be discharged should be adequate and proper. With regard to the Bill of the Rotherham Corporation, the Committee stated that it might be necessary to apply the regulations as to water supplies. Questions, too, would have to be considered in relation to the existing supply, and also respecting communications between the Corporation and the Local Government Board with regard to the condition of the present supply. The report next gave particulars of the Dewsbury and Heckmondwike Water Bill, which proposes to acquire the same supply. The Committee said they would seek to enforce the regulations as to water supplies; and their views on the Barnsley Corporation Bill as to volume of, and gauges for, compensation water, inspection of gauges, penalty, &c., would apply, *mutatis mutandis*, to this Bill. The Committee were glad to observe that provision was made in the Bill for discharging the compensation water in a regular and continuous flow during each day of 24 hours. They asked the Council to confer on them the power where necessary to protect the interests of the West Riding by seeking to be heard in Parliament against the Bills, and to instruct the West Riding Solicitor to take all necessary steps for prosecuting any such opposition. This was agreed to.

* We have since learnt that he died on Sunday evening.—ED. J.G.L.

Extension of the Constant Supply System in London.—On and after the 1st of April next, a large part of Islington, from the Angel to Highbury, will have a constant water supply instead of the present intermittent service; and afterwards, as early as the New River Company can complete the necessary arrangements, the alteration will be extended to the rest of the parish, with a population of 320,000 inhabitants.

Donald Macpherson and Co., Limited.—Under this title, a Company has been formed, with a capital of £10,000, in £1 shares, to acquire the business carried on at Manchester and elsewhere under the style of Donald Macpherson and Son, in accordance with an agreement made by the Company with D. D. Macpherson and S. W. Tamplin, and to carry on business as manufacturers of, and dealers in, oils, paints, varnishes, &c. The first Directors are Messrs. Macpherson and Tamplin (Joint Managing Directors).

Reductions in Price.—The Burslem Corporation Gas Committee have determined to reduce the price of gas by 3d. per 1000 cubic feet from March 25 next.——The Directors of the Matlock Bath Gas Company resolved last Tuesday to lower the price by 4d. per 1000 cubic feet to ordinary consumers, and 2d. to large consumers. They have also decided that from the beginning of the present year, all surplus profits, after paying dividends, shall be devoted to the benefit of the consumers.——The Directors of the Worksop Gas Company have given notice that, as from the 1st inst., the price of gas will be reduced 2d. per 1000 cubic feet for prompt payment.——The Directors of the Louth Gas Company have given notice of a reduction in price of 2d. per 1000 cubic feet; making the charge 4s., with 15 per cent. discount for prompt payment.

The Relations of Gas Companies with the Coal Trade.—Replying to the toast of the "Coal Trade" at the annual dinner of the Felling and Dunston collieries officials at Felling last Friday week, Colonel A. S. Palmer (the Chairman), referring to the condition of the trade, said he was sorry to see that so many faddists were clamouring about the electric light. They were absolutely taking the bread out of their own mouths. The coalowners were trying to keep coals at a reasonable price, and were supplying gas companies at lower prices now than they ever did before. Why, he asked, should not gas companies reduce the price of gas, and instead of paying from 10 to 15 per cent., and turning large amounts over to reserve funds, be satisfied with reasonable profits. They were, by their greed for big dividends, both ruining themselves and destroying the coal trade.

The Felixstowe Gas Company and the Local Authority.—The Committee appointed by the Felixstowe and Walton Local Board to consider the Provisional Order for which the Gas Company have made application to the Board of Trade submitted their report at the first meeting of the new Urban District Council. Among their recommendations were the following: That, as a clause empowering the Authority to acquire the undertaking at any time would be inoperative in a Provisional Order, an agreement be come to with the Company to purchase at a future date, the price for purchase not to be enhanced in consequence of statutory powers being obtained; (2) that the Company be informed that the Council would strongly oppose the manufacture of tar, pitch, and asphaltum, as provided in the Order; (3) that the Order should be altered to provide that, where paths and roads were disturbed, the work of repair should be done by the Council at the expense in all respects of the Company; (4) that a representation be made to the Company that the price of 5s. 6d. per 1000 cubic feet to be charged to private consumers was too great, especially as only 3s. 6d. was charged for cooking and engine purposes, and that they should be asked to lower it to 4s. 6d.; and (5) to prevent litigation, that the cases should be more distinctly specified in which the Company should be exempted from penalty for insufficient supply. It was suggested that, subject to these alterations, no opposition be offered to the Order. The report gave rise to a short discussion, at the close of which it was decided to instruct the Clerk to draw up such representations to the Board of Trade or the Company as the Council might think fit before the 15th inst., by which date objections must be sent in to the Board.

Public Bodies and Coal Contracts.—In the course of the proceedings at the annual conference of the Miners' Federation, held at Birmingham, under the presidency of Mr. B. Pickard, M.P., last week, Mr. B. Dean, of Walsall, brought forward the following proposition: "That, with a view to assist in the promotion of strict terms of equality between capital and labour, this conference is of opinion that, in all coal contracts which they may enter into, public bodies, such as town councils, should allow no exemption from the fulfilment of such contracts on account of any lock-out which may be made after the date upon which such contract has been entered into." In support of this proposition, he said that those of them who had been on gas committees of town councils knew that, in advertising for coal contracts, the greatest possible encouragement was given to sweating. To obtain their coal at a lower price, they gave a guarantee that, if the masters tried to recoup themselves out of the men, and the men resented it, they should be exempted from the due fulfilment of the contract. Last spring, the *Birmingham Daily Post* had an article in which it was pointed out what a stroke of business had been done for the town by the Birmingham Corporation, who went to another colliery proprietor and procured their gas and fuel coal 1s. per ton cheaper than before. As soon as the year expired, there was a discussion in the Town Council as to whether or not they should increase the price of gas on account of the losses caused by the colliers' strike. He claimed that this loss was not caused by the strike, but by the action of the Corporation in pressing the proprietors down to the lowest possible price. It was their duty to see that public money was not used to assist colliery proprietors in bringing wages down. In the course of the discussion on the motion, attempts were made to define the difference between strikes and lock-outs. The President remarked that every stoppage, caused no matter by whom, would inevitably be called a strike by the general public. He suggested that the words, "on account of any lock-out" should be altered to "on account of any stoppage consequent upon an attempt to reduce wages." With this alteration, the motion was carried; and labour representatives were asked to bring forward a similar resolution in the public bodies with which they were connected.

The New Water-Works for Swansea.—The new scheme for providing Swansea with an abundant supply of water by utilizing the watersheds at Cray has been commenced. Contracts have already been entered into for the necessary pipes; and last Tuesday the Water and Sewer Committee accepted a tender submitted by Messrs. John Aird and Co. for laying down the pipes on the route of 25 miles, from Swansea to Cray, for a little above £19,000.

A Landslip at the Washburn Reservoirs of the Leeds Corporation.—The City Engineer of Leeds (Mr. T. Hewson) reported to the Corporation Water Committee last Friday that a slip of land about 100 feet long, 14 feet wide, and 30 feet deep, has occurred on the north-east side of the Lindley Wood reservoir in the Washburn Valley. As a result, the quantity of water in the reservoir has had to be reduced from 689·80 million gallons to 279·35 million gallons, or from 55 ft. 6 in. to 38 ft. 10 in. in depth. Mr. Hewson informed the Committee that, in consequence of this mishap, there is now only 2010·29 million gallons, or 88½ days' supply of water in stock, as against 2410·24 million gallons, or 108 days' supply at this time twelve months ago.

Explosion at the Northallerton Gas-Works.—Last Wednesday morning, an explosion of gas took place at the Northallerton Gas-Works, which resulted in the Manager (Mr. W. Marshall), his son, and a stoker named Place being severely burnt. It appears that they were engaged in clearing a valve. Mr. Marshall was stooping over the valve-hole, when (in some unexplained way) the gas ignited; and a great flame burst over the faces and bodies of the three men. Mr. Marshall was seriously injured about the face and head and right arm; his son's face was also rather severely burnt; while Place had a great part of his hair singed off. Mr. Marshall, almost blinded as he was, had sufficient presence of mind to pick up a large piece of clay and throw it into the hole, which quenched the fire. He was then removed home, where his injuries were attended to by a medical man. The flame ignited the woodwork of two doors, and the shed under which the valve was situated; but the fire brigade was quickly at hand, and extinguished the flames before any considerable damage was done. Mr. Marshall is reported to be progressing well; and his son was able to continue his duties at the works after the explosion.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 115.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon investment.
£			p. c.	**GAS COMPANIES.**				£ s. d.
590,000	10	11 Oct.	10½	Alliance & Dublin 10 p. c.	10	20—21	..	5 0 0
100,000	10	,,	7½	Do. 7 p. c.	10	13½—14½	..	5 3 5
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	100	103-105*	..	4 15 3
200,000	5	14 Nov.	6½	Bombay, Limited	5	6½—6¾	..	1 16 5
40,000	5	,,	6½	Do. New	4	4½—5	..	5 4 0
380,000	Stck.	15 Aug.	11½	Brentford Consolidated	100	233—238	..	4 16 8
180,000	,,	,,	8½	Do. New	100	185—190	..	1 9 6
220,000	Stck.	28 Sept.	11	Brighton & Hove Original	100	217—222	..	4 19 1
888,500	Stck.	30 Aug.	5	Bristol	100	115—120	..	4 3 4
320,000	20	28 Sept.	11½	British	20	43½ - 45½	+½	4 10 10
50,000	10	30 Aug.	11½	Bromley, Ordinary 10 p. c.	10	21½ - 22½	..	5 2 2
51,510	10	,,	8½	Do. 7 p. c.	10	16½—17½	..	4 17 2
328,750	10	14 Nov.	2	Buenos Ayres (New) Limited	10	6 - 6½	—½	3 1 6
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	99-102*	..	5 17 8
150,000	20	12 July	8	Cagliari, Limited	20	27—28	..	5 14 3
550,000	Stck.	11 Oct.	13	Commercial, Old Stock	100	275—280	+3	4 12 10
165,000	,,	,,	10	Do. New do.	100	200—205	..	4 17 7
160,762	,,	13 Dec.	4½	Do. 4½ p c. Deb. do.	100	130—135	..	3 6 8
800,000	Stck.	13 Dec.	13	Continental Union Limited	100	240—245	+1½	5 6 1
200,000	,,	,,	10	Do. 7 p. c. Pref	100	205—210	..	4 15 3
535,000	Stck.	30 Aug.	5	Crystal Palace Ord. 5 p.c. Stk	100	117—122	..	4 1 11
486,090	10	27 July	11	European, Limited	10	23—24	+⅛	4 11 8
354,060	10	,,	11	Do. Partly paid	7½	16—17	..	4 17 1
5,646,590	Stck.	15 Aug.	12	Gaslight & Coke, A, Ordinary	100	263—268	+9	4 9 6
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	105—110	..	3 12 9
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	279—284	..	3 10 5
30,000	,,	,,	5	Do. F, 5 p. c. Pri.	100	130—135	..	3 14 1
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	200—205	..	3 13 2
1,300,000	,,	,,	7	Do. H, 7 p. c. max	100	182—187	..	3 14 11
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	275—280	..	3 11 5
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	165—170	..	3 10 7
1,061,150	,,	13 Dec.	4	Do. 4 p. c. Deb. Stk.	100	127—130	..	3 1 6
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	135—140	..	3 4 3
908,000	,,	,,	6	Do. 6 p. c. do	100	188—192	..	3 2 6
3,800,000	Stck.	14 Nov.	12	Imperial Continental	100	229 -234	+2	5 2 7
75,000	5	13 Dec.	6	Malta & Mediterranean, Ltd.	5	5—5½	..	5 9 1
560,000	100	1 Oct.	5	Met. of Melbourne, 5p. c. Deb.	100	110—112	..	4 9 3
541,920	20	14 Nov.	5	Monte Video, Limited	20	15—16	..	6 5 0
150,000	5	29 Nov.	8	Oriental, Limited	5	7—7½	..	5 6 8
60,000	5	13 Sept.	7	Ottoman, Limited	5	4½—4¾	..	7 7 4
166,870	10	31 Jan.	2	Pará Limited	10	1½—2½	..	8 0 0
420,000	100	2 Nov.	6	People's Gas of Chicago— 1st Mtg. Bds.	100	103—108	+3	5 11 1
500,000	100	1 Dec.	6	2nd Do.	100	98—103	+3	5 16 8
150,000	10	11 Oct.	6	San Paulo, Limited	10	8½—9½	..	6 6 4
500,000	Stck.	30 Aug.	15½	South Metropolitan, A Stock	100	340—345	+3	4 9 10
1,350,000	,,	,,	12	Do. B do.	100	288—293	+1½	4 1 11
260,000	,,	,,	13	Do. C do.	100	293—298	..	4 7 2
750,000	,,	12 July	5	Do. 5 p. c. Deb. Stk.	100	169—174	..	2 17 6
60,000	Stck.	30 Aug	11½	Tottenham & Edm'nton, "A"	100	225—230	..	5 0 0
				WATER COMPANIES.				
746,021	Stck.	28 Dec.	11½	Chelsea, Ordinary	100	287-292*	..	3 9 4
1,719,514	Stck.	11 Oct.	8	East London, Ordinary	100	233—238	..	3 7 3
634,740	,,	28 Dec.	4½	Do. 4½ p. c. Deb. Stk.	100	150-155*	..	2 18 0
700,000	50	13 Dec.	8½	Grand Junction	50	120—123	..	3 9 1
708,000	Stck.	15 Aug.	12	Kent	100	305—310	..	3 17 5
1,043,800	100	28 Dec.	9½	Lambeth, 10 p. c. max.	100	268-273*	+1	3 9 7
406,200	100	,,	7½	Do. 7½ p. c. max.	100	205-210*	..	3 11 5
330,000	Stck.	28 Sept.	4	Do. 4 p. c. Deb. Stk.	100	135—138	..	2 17 11
500,000	100	15 Aug.	12½	New River, New Shares	100	390—395	+3	3 1 4
1,000,000	Stck.	27 July	4	Do. 4 p. c. Deb. Stk	100	140—145	..	2 15 2
902,300	Stck.	13 Dec.	6	S'thwk & V'xhall, 10 p. c. max.	100	168—173	+1	3 9 4
126,500	100	,,	6	Do. D 7½ p. c. do.	100	160—165	..	3 12 9
1,155,066	Stck.	13 Dec.	10	West Middlesex	100	275—280	..	3 11 5

*Ex div.

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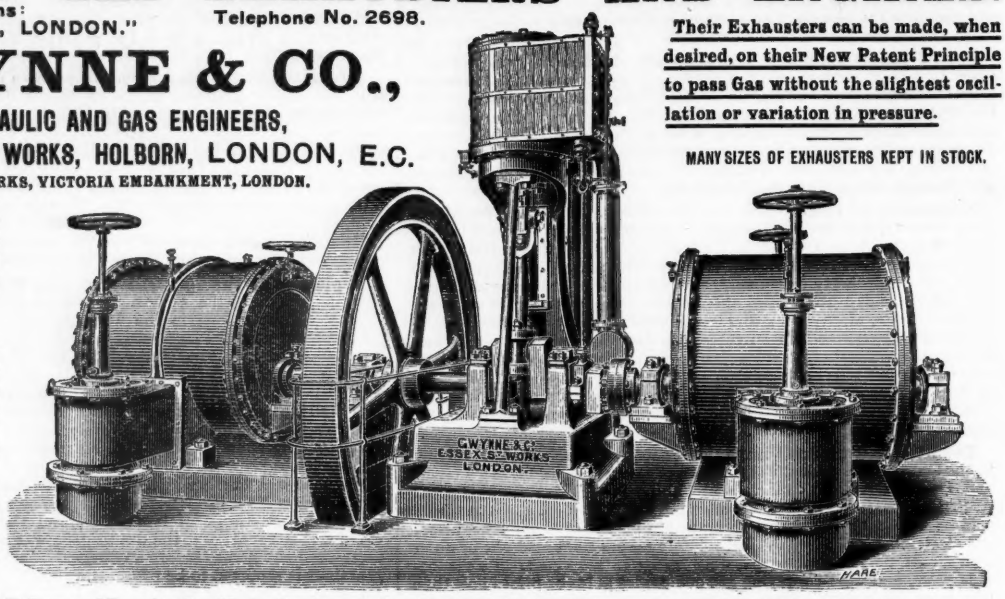

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SADLER AND CO., LIMITED, MIDDLESBROUGH; ULVERSTON (BARROW); PORTSMOUTH; CARLTON; STOCKTON; 315, St. Vincent Street, GLASGOW; and 85, Water Street, NEW YORK. Tar Distillers, Manufacturers of all TAR PRODUCTS, ALIZARINE and other TAR COLOURS, BICHROMES, OXALIC ACID, ALKALIES, LIQUOR AMMONIA, AMMONIA SULPHATE, &c.
Head Office: MIDDLESBROUGH. Correspondence invited.

AMMONIA SATURATORS.

WALTER THOMASON and SONS, Chemical Plumbers, &c., and Makers of Lead Saturators, &c., 21, WESTON STREET, BOLTON. Repairs of every description.
Please write for Estimate before ordering elsewhere.

GAS PURIFICATION.

OXIDE OF IRON BOG ORE.

BALE & CO.'S Oxide of uniform quality.
Sample and Price on application.
OXIDE PAINTS, OILS, SULPHURIC ACID, &c.
120 and 121, NEWGATE STREET, LONDON, E.C.
Telegrams: "BOGORE, LONDON."

OXIDE OF IRON.

FINEST Quality of Natural Bog Ore.
Particulars and price, apply to Mr. T. L. ARCHER, 20, Fennel Street, MANCHESTER.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for, Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings, at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER LINCOLN."

HYDRATED OXIDE OF IRON.

PREPARED from pure Iron
Two or three times as rich as Bog Ore.
Strong action on Sulphuretted Hydrogen.
To be used alone, but will increase activity of other Oxides.
Less than half the price of Bog Ore.
Can be lent on hire.
Write for tabulated results.
READ HOLLIDAY AND SONS, LIMITED, HUDDERSFIELD

WANTED, a Situation as Gas-Fitter, BELLHANGER, HOT WATER FITTER, &c.
Address B. SCUDAMORE, 13, Alexandra Buildings, Lower Weston, BATH.

ADVERTISER, with City Office, desires good AGENCY. First-Class Gas-Works Connection.
Address No. 2467, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

AS Secretary and Accountant, or Assis-tant. Advertiser desires engagement in either capacity. Fifteen years' secretarial experience. Good address. Excellent testimonials as to business qualifications.
Address No. 2456, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

ASSISTANT Engineer and Manager desires engagement as GAS MANAGER or SUB-MANAGER. Fifteen Years' experience, London and Provinces. Holds First-Class Honours in "Gas Manufacture" (City and Guilds Institute), and many Technical Awards. Excellent Testimonials as to Character and Qualifications.
Address No. 2468, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TRAVELLER.

WANTED, an experienced Traveller for the Gas-Stove Trade.
None but those fully qualified need apply (by letter only) to CHARLES WILSON & SONS, Carlton Works, LEEDS.

WATER GAS.

AN English Gas Engineering Firm desire to engage the services of an ASSISTANT well up in Water-Gas Plant.
Send full Particulars to No. 2472, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, for a Gas-Works in the Eastern Counties, a YOUNG MAN, not over 21 years of age, with a sound knowledge of Practical Chemistry, acquired by not less than Three Years' Experience in a good Laboratory. Testimonials not to be forwarded. Salary £75 per annum.
Apply, by letter, to No. 2469, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

A LARGE Provincial Gas Company require the services of a Smart Man, whose duty it will be to call on Gas Consumers within their district to induce them to adopt the newest Burners and the best arrangements for Lighting their Premises.
Apply, stating Age, Salary required, and previous Experience, to No. 2471, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

THE Town Commissioners of Bangor, county of Down, Ireland, require an experienced GAS ENGINEER, to prepare Plans for the Extension of their Gas-Works.
Apply, by letter (stating Terms, and enclosing Testimonials), to the Clerk, on or before Monday, the 21st inst.
By order,
FRANCIS POLLOCK,
Town Clerk.
Bangor, Jan. 9, 1895.

BOROUGH OF WEST BROMWICH.

THE Gas Committee of the Corporation are prepared to receive APPLICATIONS for the appointment of MANAGER of their Gas-Works, situate at Albion, West Bromwich.
The person appointed will be required to devote the whole of his time to the service of the Corporation.
Salary, £250 per annum, with Residence at the Works, Rates, Taxes, Fuel, &c., free.
Applications, stating Age, and enclosing Testimonials, to be delivered at this Office, endorsed "Gas-Works Managership," not later than Saturday, the 19th inst.
Canvassing, either personally or otherwise, will be a disqualification.
Any further information may be obtained from the undersigned.
By order,
THOS. HUDSON,
Secretary.
Gas Department, Town Hall,
West Bromwich, Jan. 2, 1895.

WANTED, Two Second-hand Purifiers, 12 or 14 feet square.
Apply to No. 2470, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

SHEFFIELD UNITED GASLIGHT COMPANY.
(NEEPSEND STATION.)

TO IRONFOUNDERS, ETC.

THE Directors of this Company invite TENDERS for the Manufacture and Delivery (without erection) of CASTINGS required in the Construction of Four Purifiers, 62 ft. by 20 ft., with COLUMNS and GIRDERS, for their No. 3 Purifying-House.
Drawings may be seen, and Bill of Quantities, with Specification and Form of Tender, obtained, on application to the Engineer, Mr. Fletcher W. Stevenson.
Sealed tenders, endorsed "Tender for Castings for Purifiers," to be delivered (by post) to the undersigned, at the Company's Offices, on or before the 26th day of January next.
The Directors do not bind themselves to accept the lowest or any tender,
HANBURY THOMAS,
General Manager.
Commercial Street, Sheffield,
Jan. 5, 1895.

SHEFFIELD UNITED GASLIGHT COMPANY.
(NEEPSEND STATION.)

TO BOILER MAKERS, CONTRACTORS, ETC.

THE Directors of this Company invite TENDERS for the Manufacture, Delivery, and Erection of Four WROUGHT-IRON PURIFIER-COVERS, 20 feet square, for their No. 3 Purifying-House.
Copy of the Drawing and Specification, with Form of Tender, can be obtained on application to the Engineer, Mr. Fletcher W. Stevenson.
Sealed tenders, endorsed "Tender for Purifier-Covers," to be delivered (by post) to the undersigned at the Company's Offices, on or before Saturday, the 26th day of January next.
The Directors do not bind themselves to accept the lowest or any tender.
HANBURY THOMAS,
General Manager.
Commercial Street, Sheffield,
Jan. 5, 1895.

BOROUGH OF NELSON.
(GAS DEPARTMENT.)

THE Gas Committee of the above Corporation invite TENDERS for FIRE-CLAY RETORTS.
Quantities and Form of Tender may be obtained upon application to Mr. Foster, Gas Manager.
Sealed tenders, endorsed "Retorts," to be sent to me not later than Wednesday, the 30th day of January, 1895.
By order,
R. M. PRESCOTT,
Town Clerk.
Town Hall, Nelson,
Jan. 11, 1895.

TO RETORT & FIRE-BRICK MANUFACTURERS.

THE Corporation of Birkenhead are prepared to receive TENDERS for RETORTS, FIRE-BRICKS, BLOCKS, and FIRE-CLAY required at their Gas-Works during the current Year.
Forms of Tender may be obtained from Mr. T. O. Paterson, Gas Engineer, Gas-Works, Thomas Street.
Tenders, sealed and endorsed "Tender for Retorts, &c.," to be sent in to me not later than Five o'clock in the afternoon of Friday, the 18th of January, 1895.
The Corporation do not bind themselves to accept the lowest or any tender.
By order,
ALFRED GILL,
Town Clerk.
Town Hall, Birkenhead,
Jan. 5, 1895.

Gas and Water Stocks and Shares in the
West Ham Gas Company,
Southend Gas Company,
Woking District Gas Company, and in the
South-West Suburban Water Company, Limited,
TO BE SOLD BY AUCTION, BY

MR. ALFRED RICHARDS, at the Mart, E.C. on Monday, Jan. 21, at Two, in Lots.
Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

NOTICE.

TO GAS ENGINEERS AND OTHERS.

MESSRS. CLAPHAM BROS., Limited, Keighley, Yorkshire, are no longer authorized to Manufacture my CONDENSER and WASHER-SCRUBBERS.
The above-named Gas Apparatus are erected and giving entire satisfaction at the following places: Neath, Lincoln, Sheffield, Ellesmere, Mountain Ash, Malden, Cullingworth, Montreal (Canada), Woodstock (South Africa), Cape Town (South Africa), &c.
These Appliances can now be obtained solely of the undersigned.
Winchester House, London, E.C. J. A. KELMAN.

NOTICE.

TO GAS ENGINEERS AND OTHERS.

CLAPHAM BROS., LIMITED, of Keighley, Yorks., beg to intimate that they are the SOLE MAKERS of LAYCOCK & CLAPHAM'S "ECLIPSE" WASHER-SCRUBBER, and that no person or persons beyond the Patentees and Makers have ever had any interest whatever in the Patent.
They are also the SOLE MAKERS of CLAPHAM'S PATENT IMPROVED "ECLIPSE" CONDENSER, as supplied to Bradford, Manchester, and other Gas-Works.
Orders and Inquiries promptly attended to. See advertisement in last week's JOURNAL, p. 100.

In Paper Cover, Price 1*s.*

GASHOLDERS
WITH OR WITHOUT
GUIDE-FRAMING.

A Discussion between E. LLOYD PEASE and F. SOUTHWELL CRIPPS.

To which is added a Synopsis of

LITERATURE ON GASHOLDER CONSTRUCTION,

Containing references to all the Literature (English and Foreign) on Reducing or Abolishing the Guide-Framing of Gasholders, also the principal Literature on Gasholder Construction generally, compiled to March, 1893; with a List of all the English and Foreign Periodicals connected with the Gas Industry.

COMPILED BY

F. SOUTHWELL CRIPPS,

Associate Member of the Institution of Civil Engineers; Fellow of the Imperial Institute; Member of the Institution of Gas Engineers; Member of the Society of Arts;
AUTHOR OF
"The Guide-Framing of Gasholders and Strains in Structures Connected with Gas-Works;"
"The Flow of Gases and Proportioning Gas-Mains," &c.

LONDON:
WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

Price 6*s., Cloth Bound,*

THE CHEMISTRY OF ILLUMINATING GAS,

By

NORTON H. HUMPHRYS, Assoc. M.Inst.C.E., F.C.S

This work contains chapters on: The Relative Cost of Light from Gas, Oil, and Candles; Products of Combustion; The Sulphur Question; The Composition of Illuminating Gas; Water Gas; Various Gas-Making Processes; Oil Gas; Properties of Fluid Hydrocarbons; Tar for Gas-Making; Destructive Distillation Condensation; and Purification.

LONDON:
WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

HARCOURT'S COLOUR TEST.

For Carbon Bisulphide, Sulphuretted Hydrogen, and Carbonic Acid in Coal Gas.

The Materials for the above Tests may be obtained from
Mr. S. E. MILLER, 115, Cowley Road, Oxford.

ALEXANDER CAMERON,

CANNEL & GAS COAL MERCHANT,

48, WEST REGENT STREET,
GLASGOW.

NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO

THE LOTHIAN COAL COMPANY,
LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH, N.B.

HOLMSIDE GAS COALS.

PRESENT DAILY PRODUCE OVER 4000 TONS.

LATEST ANALYSIS:—

Yield of Gas Per Ton . .	11,205 Cubic Feet.
Illuminating Power,	16 7/10 Stand. Sperm. Candl.
Coke (of good & pure quality)	13¾ Cwt. Per Ton.
Sulphur	A little over 1 Per Cent.
Ash	Under 1 Per Cent.
Tar	163 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor	103 Lbs. (Avoir.) Per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR PELTON GAS COALS.

PRESENT DAILY PRODUCE AVAILABLE, 2500 TONS.

RESULTS OF DIFFERENT ANALYSES:—

Yield of Gas Per Ton . .	10,500 Cubic Feet.
Illuminating Power .	17 Stand. Sperm Cand'.
Coke (of excellent quality) .	13½ Cwt. Per Ton.
Sulphur	1·13 Per Cent.
Ash.	1·34 Per Cent.
Tar	180 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor	94½ Lbs. (Avoir.) Per Ton.

The HOLMSIDE and SOUTH MOOR COAL-FIELD possesses *a very great quantity of the best Coal;* and, whilst other Coal-Fields are becoming exhausted, this one is only being opened out, so that *the quality* of both the HOLMSIDE COALS, and the SOUTH MOOR COALS *may be relied upon for all practical purposes.*

These Coals may be bought through the Principal Merchants in England, or direct from

MR. MARK ARCHER,
HOLMSIDE AND SOUTH MOOR OFFICES,
NEWCASTLE-UPON-TYNE.

GAS-RETORTS. FIRE-BRICKS.

Société de Produits Refractaires

DE SAINT-GHISLAIN (BELGIUM).

LUMPS, TILES, FIRE-CEMENT, &c.

EXPORTATION *via* ANTWERP.

REGENERATIVE GAS-FURNACES—PRINCIPE DE BROUWER.

HUNTER'S

OXIDE OF IRON.

JAMES HUNTER, MINER, AND SHIPPER OF NATURAL IRISH BOG ORE.

This Estate yields the finest and most uniform quality in Ireland; and the quality is guaranteed.

Samples and Prices on application.

11, BAY STREET, PORT GLASGOW.

Telegrams: "HUNTER, PORT GLASGOW."

Established 1872.

SULPHATE OF AMMONIA SATURATORS.

JOSEPH TAYLOR & CO.,

Central Plumbing Works, Town Hall Square, BOLTON.

Practical Makers of all kinds of Saturators, and Specialists in every description of Lead Work required in connection with Sulphate Plants.

Special attention to Repairs.

Improved Lead-Burning Machines, Sulphate Bagging Machines, Copper Scoops, &c.

HIGHEST REFERENCES ON APPLICATION.

LONDONDERRY GAS COALS

FROM THE

MARQUIS OF LONDONDERRY'S COLLIERIES,

COUNTY OF DURHAM.

Available output up to 5000 tons per day. Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by Mr. John Pattinson, F.C.S., F.I.S.

FOR PRICES AND PARTICULARS, APPLY TO

S. J. DITCHFIELD,

SEAHAM HARBOUR, COUNTY OF DURHAM.

LABORLESS WORK In 1895.

ENGINEERS AND MANAGERS

Making preparations to adopt

SELF-ACTING SYSTEMS OF CARBONIZING In 1895,

are cordially invited to call and inspect our latest Designs of Automatic Coal and Coke Handling and Charging Machinery.

We send skilled Draughtsmen to get Particulars for Detail Plans.

Address:—

NEW CONVEYOR CO., LTD.,

3 & 4, LIME STREET SQUARE, LONDON, E.C.

BOLDON GAS COALS.

Worked by THE HARTON COAL CO., LTD.

Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton	10,500	Cubic Feet.
Illuminating Power	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Crystal Palace District Gas Company, Bombay Gas Company, San Paulo Gas Company, Ipswich Gaslight Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For prices, &c., apply to the

HARTON COAL COMPANY, LIMITED,

Newcastle-on-Tyne.

W. H. PARKINSON, FITTER.

THE SILICA FIRE-BRICK COMPANY,

OUGHTIBRIDGE, near SHEFFIELD,

MANUFACTURE

SILICA BLOCKS, BRICKS, AND CEMENT

OF SUPERIOR QUALITY

FOR GAS-FURNACES.

Trade Mark: "SILICA."

These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their

GREATER DURABILITY.

Strongly recommended where EXCESSIVE HEATS have to be maintained.

PIPES, 2-in. to 8-in. PIPES, 2-in. to 8-in. PIPES.

MONIER-WILLIAMS & Co.

IRONFOUNDERS,

MIDDLESBROUGH.

COKE BREAKERS.

G. R. Mather & Son, Engineers, Wellingborough

HEBBURN MAIN GAS COALS.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·4 candles.
Coke	68 per cent.

For prices, f.o.b. Ship or Delivered by Rail, apply to

THE WALLSEND & HEBBURN COAL COMPANY, LTD.,

B Lombard Street, NEWCASTLE-ON-TYNE.

W. RICHARDSON, Fitter.

COKE BREAKERS,

PRICES REDUCED.

(THOMAS & SOMERVILLE'S PATENT.)

New Design, with two Cutting Rollers, making less Breeze than their old pattern.

GEORGE WALLER & CO.,

PARK STREET, SOUTHWARK, E.C.,

And at STROUD, GLOUCESTERSHIRE.

HEATHCOTE GAS COAL.

Rich in Illuminating Power & Yield of Gas.

Above the average in Weight & Quality of Coke.

Maintains a High Standard in Residuals.

THE GRASSMOOR Co., Ld.,

CHESTERFIELD.

ALFRED WILLIAMS & CO.

[MATTHEW MILDRED]

70, 71, 72, & 73, BANKSIDE,

SOUTHWARK, S.E.

UNIVERSAL PROVIDERS

FOR

GAS, WATER, & SEWAGE WORKS.

ENGINEERS & CONTRACTORS

For the Erection of Complete Gas and Water Works, and for Renewals and Extensions of every description.

PLANS & ESTIMATES ON APPLICATION.

MAIN LAYING AND RETORT SETTING.

THOMAS TURTON AND SONS, LIMITED,

SHEAF WORKS, SHEFFIELD,

MANUFACTURERS OF

FILES OF BEST QUALITY

FOR ENGINEERS.

STEEL OF ALL DESCRIPTIONS.

SCREW STOCKS, TAPS AND DIES, SPANNERS, RATCHET BRACES, LIFTING JACKS, ANVILS, VICES, AND ENGINEERS' TOOLS GENERALLY.

London Office:

90, CANNON STREET, E.C.

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD

BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.

RAVENSTHORPE, NEAR DEWSBURY.

KENT'S THICK GAS COAL

RAISED AT

The Wharncliffe Woodmoor Colliery,

BARNSLEY.

Yield of Gas, nearly 12,000 *Cubic Feet per ton of Coal; and Illuminating Power, nearly* 17½ *Candles.*

The following is a complete ANALYSIS made by Mr. R. O. PATERSON, C.E., Gas-Works, Cheltenham:—

Specific Gravity (Water 1)	1·276
Weight of One Cubic Foot	79·700 lbs.

PROXIMATE ANALYSIS.

Moisture in Coal	2·68 per cent.
Volatile Matter	35·60 ,,
Fixed Carbon	58·80 ,,
Sulphur	0·96 ,,
Ash	1·96 ,,

COMMERCIAL ANALYSIS.

Gas per Ton of Coal	11,760 cub. feet.
Gas per Cubic Foot of Coal	418 ,,
Illuminating Power	17·44 candles.
Value of One Cubic Foot in Sperm	418 grains.
Value per Ton of Coal in Sperm	703 lbs.
Coke per Ton of Coal	1367 ,,
Coke	61·05 per cent.
Ash in Coke	3·21 ,,
Sulphur Eliminated with Volatile Products per Ton of Coal	9·4 lbs.
Sulphur in Coke per Ton of Coal	12 ,,
Ammoniacal Liquor per Ton of Coal	19·7 galls.
Tar per Ton of Coal	12·2 ,,

R. O. PATERSON, C.E.

Gas-Works, Cheltenham,
8th August, 1894.

For Price, &c., apply to

THE

Wharncliffe Woodmoor Colliery Co LIMITED,

BARNSLEY.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887,

for

CANNEL & COAL.

TYNE

BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to

THOS. W. DANCE & SONS,

COAL OWNERS, NEWCASTLE-ON-TYNE;

OR

E. FOSTER & CO.,

21, JOHN STREET, ADELPHI, LONDON, W.C.

T. B. KITTEL, SHEFFIELD.

CONTRACTS FOR SUPPLIES OF ANY OF THE PRINCIPAL

ENGLISH & SCOTCH CANNELS.

REAL SILKSTONE GAS COAL

ANALYSIS AND PRICES ON APPLICATION.

T. B. KITTEL, SHEFFIELD.

TROTTER, HAINES, & CORBETT,

Brettell's Estate

FIRE-CLAY & BRICK WORKS,

STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS TILES, and every description of FIRE-BRICKS.

Proprietors of

BEST GLASSHOUSE POT & CRUCIBLE CLAY.

SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

THORNLEY GAS COALS

WORKED BY THE

WEARDALE IRON AND COAL COMPANY, Ld.

OUT OF THEIR

THORNLEY AND WHEATLEY HILL COLLIERIES.

The Analysis made by Messrs. J. and H. T. Pattinson, Public Analysts for Northumberland, gives 10,500 cubic feet of Gas per ton, with an Illuminating Power of 16·3 Candles and 67·3 per cent. of Coke. The following is a Working Analysis made of these Coals by the Tudhoe and Sunderland Bridge Gas Company:—

[COPY.]

TUDHOE AND SUNDERLAND BRIDGE GAS COMPANY.

Tudhoe Gas-Works,
Spennymoor,
8th June, 1893.

Messrs. The

WEARDALE IRON & COAL COMPANY, LTD.

GENTLEMEN,

For the last two months we have used your **THORNLEY GAS COAL** exclusively at these gas-works; and I have pleasure in herewith giving you the actual results obtained during the trial.

Yield of Gas per ton: 10,300 cubic feet.

Yield of Coke: 13½ cwt.

Illuminating Power of Gas, average of a series of tests, **17 Sperm Candles.**

The Coke was of excellent quality.

The following is a complete ultimate Analysis of the Coal.

	Per Cent.
Carbon	83·128
Hydrogen	5·116
Oxygen	7·401
Nitrogen	0·585
Sulphur	0·620
Ash	3·130
Water	0·020
	100·000

Analysis of the Coke.

Carbon	93·31
Sulphur	0·61
Ash	5·00
Moisture	1·08
	100·00

I am, Gentlemen,
Yours truly,
A. B. COWAN,
Manager.

For Price, &c., apply to the

WEARDALE IRON & COAL Co., Ld.

QUAYSIDE, NEWCASTLE-ON-TYNE.

CLAYTON SON & Co., LTD, LEEDS

MAKERS OF

LARGEST GASHOLDER IN THE WORLD

ALSO THE LARGEST METAL TANK

See Advertisement last week, also next week

MAKERS OF RETORT-LIDS OF ALL FORMS & SHAPES BY SPECIAL HYDRAULIC MACHINERY

R. DEMPSTER & SONS, LTD.

Every Description of Gas Apparatus.

ELLAND, YORKS.

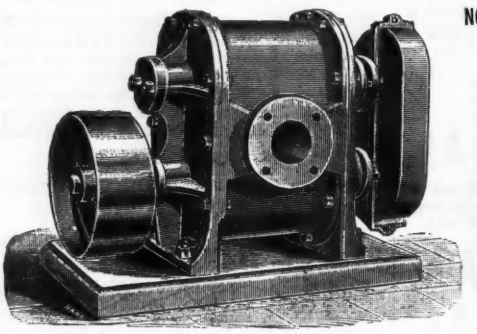
JOHNSON'S PATENT

DRUM PUMP AND GAS EXHAUSTER.

The Pump of the future for quickly and economically moving large bodies of Water, Semi-Fluids, &c.

The force of the Piston Pump with the capacity of the Centrifugal combined.

NO SLIDES OR FRICTIONAL WORKING PARTS.



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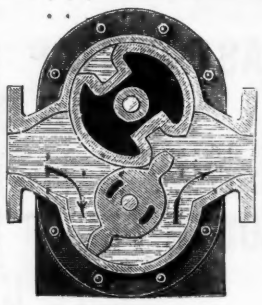

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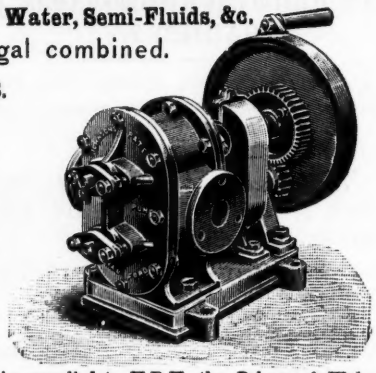
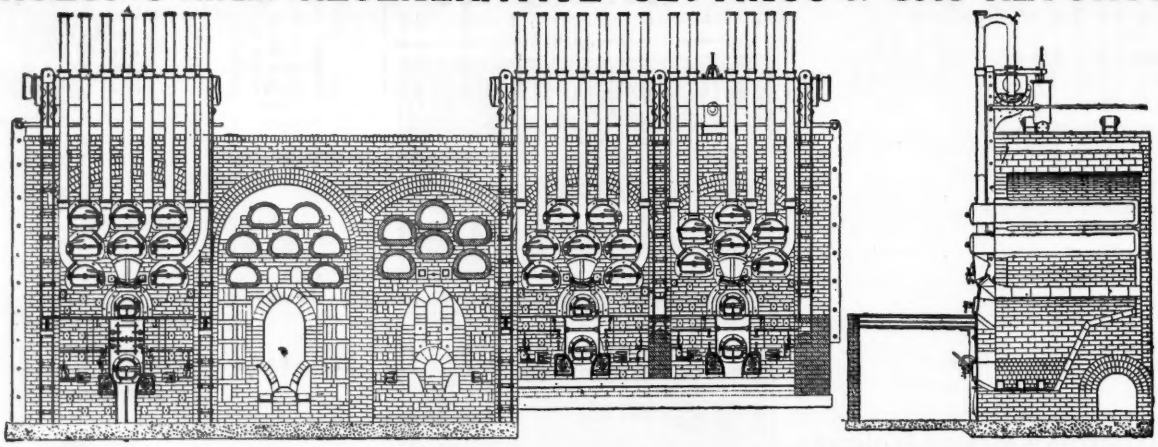


As supplied to H.R.H. the Prince of Wales for Pumping Gas Liquor at his Sandringham Gas-Works.

DRUM ENGINEERING COMPANY,

Hydraulic and Pneumatic Engineers, 55, ATHOL ROAD, BRADFORD.

HISLOP'S PATENT REGENERATIVE SETTINGS OF GAS-RETORTS.



THESE SETTINGS ARE POSITIVELY UNRIVALLED IN PRODUCTIVE CAPACITY, DURABILITY, AND SIMPLICITY OF MANAGEMENT. RETORTS OF ORDINARY DIMENSIONS, CARBONIZING FROM 18 TO 24 CWT. OF ENGLISH AND 21 TO 26 CWT. OF SCOTCH COAL PER 24 HOURS, DEPENDING UPON THE NATURE OF THE COAL, AND PRODUCING UP TO FULLY 13,000 CUBIC FEET PER MOUTHPIECE IN THE SAME TIME, AND WITH THE SMALLEST EXPENDITURE OF FUEL ATTAINABLE, AND RETURNING IN PROFIT THE ENTIRE COST OF ERECTION WITHIN TWELVE TO EIGHTEEN MONTHS; AND THUS REDUCING TO INSIGNIFICANCE THE INCREASED COST OF THESE SETTINGS OVER THE COMMON OR GENERATOR FURNACE SYSTEMS.

THESE SETTINGS ARE EXTENSIVELY ADOPTED, AND ARE ERECTED UPON THE SHALLOW AND STAGE FLOOR PLANS. THEY ARE ADAPTED TO ANY EXISTING ARRANGEMENTS, AND PERFECT SATISFACTION GUARANTEED. THE COMPOSITION OF FIRE-RESISTING AND OTHER SPECIAL FIRE-CLAY MATERIALS FURNISHED IS OF THE HIGHEST ORDER; AND THE SYSTEM AS A WHOLE, AS NOW PERFECTED, IS THE RESULT OF LONG EXPERIENCE AND CAREFUL STUDY OF THE PRINCIPLES OF GASEOUS FIRING.

Drawings and Specifications are furnished for the complete erection of Ovens, with or without Retort and Bench Mountings; or complete erection undertaken if required, and carried out by specially Trained Workmen.

Further particulars may be obtained on application to the Patentee's Agents: C. M. HAMILTON, 5, Stuart Street, Shawlands, Glasgow; J. E. FISHER, Stourbridge; JOHN WALSH & SONS, Retort Builders, Halifax, Yorkshire; RICHARD TURNER, Retort Builder, Denton, Lancashire; and from the Principal Agent, R. F. HISLOP (son of Patentee), Gas-Works, Paisley, N.B.

HISLOP'S PATENT HYDRAULIC MAIN SEAL-REGULATING AND TAR-EXTRACTING VALVE is a *Sine quâ non*

TO THE SATISFACTORY WORKING OF THE HYDRAULIC MAIN UNDER THE REGENERATIVE AS WELL AS OTHER SYSTEMS OF RETORTS. BEING LARGELY ADOPTED AND AFFORDING THE HIGHEST SATISFACTION.

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Under G. R. HISLOP'S Patents, all Spent Limes are most effectually, economically, and continuously recovered at from one-third to one-half the cost of New Lime. The results are a surprise to all who have inspected the process, and are entirely satisfactory to all now using it.

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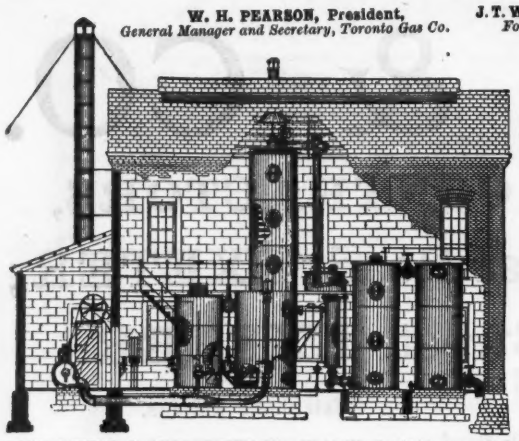
L. L. MERRIFIELD, Chief Engineer,
Formerly Engineer for the United Gas Improvement Company, U.S.A.



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1. Smooth interior, preventing adhesion of Carbon.
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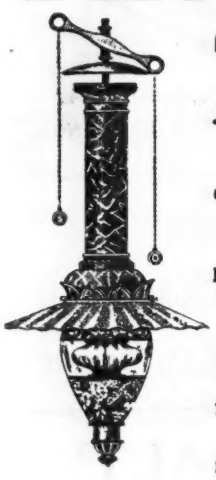

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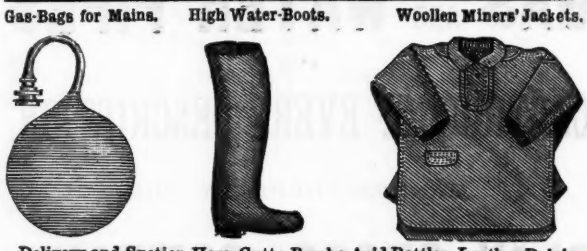

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[See Illustrated Advertisement, Jan. 1, p. 9.]

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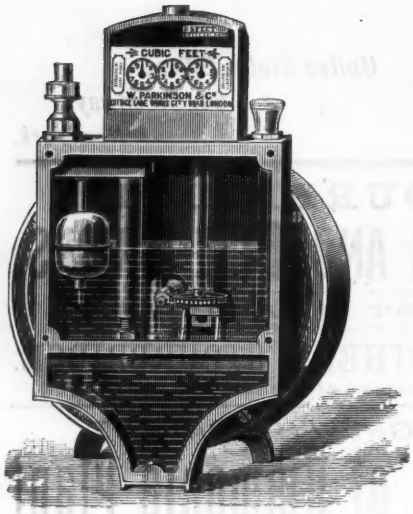

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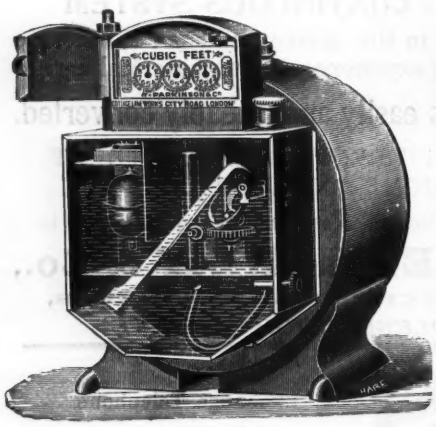

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The Slow-Spoon Compensator has been in extensive use for many years; it maintains an unvarying water-line without appreciable friction, and provides a large reserve of water. The Float arrangement allows sudden or excessive pressure on the Inlet without affecting the working of the Meter or extinguishing the Lights.

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Telegraphic Address: "GAS-METERS."

[See also Advt., p. 112.

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